MIKE WEISS

Learn and Connect
At NSTA's Atlanta Conference 10

NSTA Reports
National Science Teachers Association

NSTA Press Excerpt:
Creating a STEM Culture for Teaching and Learning 17

CONTENTS

3 Is Research Worth Reading?

4 Money 101: A Cheat Sheet on Tax Reform

8 NSTA Member Poll: Educators Reflect on Their Science Methods Courses

10 Learn and Connect at NSTA's Atlanta Conference

GRAB BAG
Pull-Out Section!

G1 Freebies
G3 News Bits
G4 What's New
G7 In Your Pocket
G8 Summer Programs

12 Ask a Mentor: Advice on Considering Relocations, Discipline, Differentiation, and Scaffolding Lessons

15 Blick on Flicks: *Downsizing*: Global Thinking on a Small Scale

17 NSTA Press Free Chapter Excerpt: *Creating a STEM Culture for Teaching and Learning*

19 Mark Your Calendar, NSTA's New Engineering E-Mail List

20 3-D Printing Copies Properties of Human Tissues

Unlocking Science in Breakout Games

The popularity of escape rooms—physical adventure games in which players solve a series of puzzles to break out of a locked room—has carried over into science classrooms nationwide. "I have used [science-themed] breakout boxes, [games in which] the students have to break into a box by answering questions to get the right combination to a series of locks," says Dean Goodwin, upper-school science teacher at The Tatnall School in Wilmington, Delaware. His high school juniors and seniors "work together as a team to problem-solve and reinforce what they've learned in class…The questions have to be discussed among themselves," he explains.

In his climate change–themed game, for example, Goodwin says he gives his students the clue "in 2016, the level of carbon dioxide hit which number?" Students then use that number to either unlock a lock or solve the next problem. "They have a sense of achievement when they manage to figure out a clue and take a lock off," he relates.

"I have my students develop their own games to share and field-test with their classmates," says Goodwin. He points teachers to the BreakoutEDU immersive learning games platform (*www.breakoutedu.com*), which has free resources for teachers to create and share breakout games, along with breakout boxes, locks and other supplies, and games for purchase.

"A few years ago, a former colleague [Matt Buckley, director of educational technology at Bishop McNamara High School in Forestville, Maryland] and I created a BreakoutEDU game related to 2D projectile motion for my high school freshman conceptual physics classes. The storyline is the mystery of D.B. Cooper [who hijacked a Boeing 727 aircraft in 1971, escaped with $1 million, and has never been found], and students are asked to do 1D and 2D motion calculations [to break into the box]," says Samantha Reich, who now teaches physics and chemistry at Boston's Beaver Country Day School. "We played [BreakoutEDU's] team-building games as faculty and thought it would be a good game to review content and a good team-building activity for students. Students didn't forget the game, so I was able to refer to it later in the year."

Reich's game included both physical and digital clues. "Students were given a fake flight manifesto and had to calculate where D.B. Cooper landed [to open locks]. At the end, they had to walk [virtually via Google Cardboard] into a restaurant and figure out where D.B. Cooper is," she explains. "We gave them a lot of information, but some of it was extra and not needed [to solve the problems]. There were

Breakout Boxes, pg 6

NICOLE FULLERTON, MARKETING & COMMUNICATIONS MANAGER, TIPTON COMMUNICATIONS

Dean Goodwin, upper-school science teacher at The Tatnall School in Wilmington, Delaware, uses breakout box games that allow his students to collaborate and solve problems to get the combinations to a series of locks.

WildCam Lab

Investigate ecological questions by exploring trail camera data using an interactive map. Filter and download data to perform analyses and test hypotheses. As an educator, you can set up private classrooms and invite your students to join. Curate data sets or let your students explore on their own. Guided activities and supporting educational resources are also available.

WildCam Gorongosa

hhmi | BioInteractive

lab.wildcamgorongosa.org

COMMENTARY: **Deborah Hanuscin**

Is Research Worth Reading?

By Deborah Hanuscin

STEVE ADAMS, UNIVERSITY OF MISSOURI

Deborah Hanuscin

As a university faculty member and researcher, a regular part of my job includes reading research journals. As a former elementary teacher, however, I realize that digging into a 25-page academic article might not spark joy in the heart of a typical classroom teacher. Plus, research journals that are readily available to the university community through institutional subscriptions are not accessible to teachers. When journals are available, wading through multitudes of study topics to find those most relevant can be daunting. Not to mention, most articles are written for an academic audience, rather than for classroom teachers.

Given all of this, teachers may wonder: Is research worth reading? My answer is a resounding "Yes!" And the NSTA Research Committee agrees. Each year, the committee selects articles describing studies with the most practical relevance to classroom teachers, and shares them with NSTA members.

The National Association for Research on Science Teaching (NARST) publishes the *Journal of Research on Science Teaching* (*JRST*), which is widely respected and read worldwide. The studies published in this journal have undergone a rigorous peer review process and represent some of the very best research in science education. Four *JRST* articles were recognized by the NSTA Research Committee in 2017:

In "Designing, Launching, and Implementing High-Quality Learning Opportunities for Students That Advance Scientific Thinking," Hosun Kang, Mark Windschitl, Jessica Thompson, and David Stroupe identify key principles teachers need to consider when selecting or designing tasks for a lesson, and launching and implementing lessons with students to support deep learning as outlined by the *Next Generation Science Standards*. They discuss *high intellectual demand tasks* with potential for advancing students' thinking by inviting them to link observable phenomena and unobservable ideas, and stress the importance of beginning lessons with this kind of task.

In "What Students Learn From Hands-On Activities," Martin Schwichow, Corinne Zimmerman, Steve Croker, and Hendrik Härtig compared the effects of hands-on versus paper-and-pencil training on students' acquisition of a fundamental experimentation skill: the control-of-variables-strategy (CVS). They explain why teachers should plan lessons that challenge students' expectations and encourage reflection, and point out the importance of assessment that is consistent with instruction. They also provide examples of effective learning tasks and fair assessments that teachers can download and access.

Hayat Hokayem and Amelia Wenk Gotwals describe a learning progression of systemic reasoning in ecology for lower-elementary students in "Early Elementary Students' Understanding of Complex Systems: A Learning Progression Approach." They explain how different levels of systemic reasoning can be used as a basis to design formative assessments and support students with strategies to move their reasoning to higher levels. Specifically, incorporating modeling and media teaching strategies to scaffold students may help them progress to high-level reasoning. This study highlights a need to increase discussion and sensemaking opportunities in science classrooms.

In "The Practice of Using Evidence in Kindergarten: The Role of Purposeful Observation," Sabela F. Monteira and María Pilar Jiménez-Aleixandre suggest that at a young age, when given appropriate learning opportunities, children are able to relate evidence and claims. They characterize *purposeful observation* as a useful tool for young children to engage actively in scientific practices, such as generating firsthand data that can be used to build evidence. At the beginning of the project, children were asked to care for snails every day and pose questions about what they wanted to know. The class decided, with great input from the teacher, ways to pursue the answers, which consisted of collecting data by carrying out both experiments (called "investigating") and purposeful observations (called "discovering"), and drawing conclusions.

The study details how this project provided opportunities for children's engagement in scientific practices, and how the teacher supported this by prompting children to conduct systematic observation, paying attention to their ideas and legitimizing them. These strategies could be used by classroom teachers for other projects as well!

You can find teacher-friendly abstracts, full-text articles, and additional resources on the NSTA Learning Center website (you'll find my own Research Worth Reading Collection at *https://goo.gl/Z4PQJp*). The Research Matters podcasts (also in the Learning Center) feature conversations with researchers about the implications of their work for the classroom. Don't forget: As an NSTA member, you also have digital access to the *Journal of College of Science Teaching*, even if you receive a different NSTA journal in the mail.

NSTA's Position Statement on Research encourages researchers to share results with the wider science education community inside and outside the classroom. A great deal of research, like the examples mentioned earlier, is being conducted in science education across the world. Much of it appears in academic research journals, though—which aren't always the most accessible read. The NSTA Research Committee is investigating how classroom teachers use education research to inform their teaching. You can assist this process by taking a brief survey (*https://goo.gl/d8G75M*). We want to know how research findings help you support student learning, what you find most useful and worthwhile to learn about current research, and what format(s) are most accessible to you. ●

Deborah Hanuscin is the NARST liaison to NSTA. Her own research on elementary science teacher development has been recognized twice by NSTA's Research Worth Reading initiative.

NSTA Reports

National Science Teachers Association
1840 Wilson Boulevard
Arlington, Virginia 22201-3092
703-243-7100
nstareports@nsta.org

Lynn Petrinjak ..... *Managing Editor*
Debra Shapiro ..... *Associate Editor*
Will Thomas, Jr. ..... *Art Director*
Production Staff ..... Jack Parker
Catherine Lorrain
Kenneth Roberts .. *Asst. Exec. Dir. for Periodicals*
David Beacom ..... *Publisher*
David L. Evans ..... *Executive Director*
Advertising
Jason Sheldrake ..... *Director*
jsheldrake@nsta.org
703-312-9273

MONEY 101

A Cheat Sheet on Tax Reform

By Kelly Kenneally

2018 Rate	Single Filer Taxable Income	Married Joint Filer Taxable Income	Married, Separate Filer Taxable Income	Head of Household Filer Taxable Income
10%	$0 to $9,525	$0 to $19,050	$0 to $9,525	$0 to $13,600
12%	$9,526 to $38,700	$19,051 to $77,400	$9,526 to $38,700	$13,601 to $51,80
22%	$38,701 to $82,500	$77,401 to $165,000	$38,701 to $82,500	$51,801 to $82,500
24%	$82,501 to $157,500	$165,501 to $315,000	$82,501 to $157,500	$82,501 to $157,500
32%	$157,501 to $200,000	$315,001 to $400,000	$157,501 to $200,000	$157,501 to $200,000
35%	$200,001 to $500,000	$400,001 to $600,000	$200,001 to $300,000	$200,001 to $500,000
37%	$500,001 or more	$600,001 or more	$300,001 or more	$500,001 or more

The Tax Cuts and Jobs Act, enacted in the closing days of 2017, marks the most significant reform of the U.S. tax code in more than 30 years. It has the potential to impact Americans' decision-making and pocketbooks; the jury is still out on whether the changes will provide substantial tax relief for most Americans. A multitude of factors—from location to age, income, and health—will determine how individuals and families fare.

You have some breathing room to determine what the new tax law may mean for you. While most changes to the tax code will take effect this year, your 2018 taxes won't be filed until 2019. More good news is that some Americans may see a difference in their paychecks in the form of lower taxes as early as this month.

As Americans begin to make sense of the changes, here's a cheat sheet with some elements of the law likely to be relevant to education professionals.

Different changes have been made to business and individual tax rates.

The new law permanently cuts most corporate rates from 35% to 21%. The law also lowers taxes for "pass-through" businesses. Owners, partners, and shareholders of some corporations, limited liability corporations, and partnerships who pay or "pass" their business taxes through their individual tax returns would see their tax rate lowered to 20%.

Many experts worry that these corporate tax cuts could significantly increase the federal deficit—by $1.46 trillion over the next decade, according to the nonpartisan Joint Committee on Taxation. Rising deficits could trigger mandatory cuts to programs like Medicare, Medicaid, and Social Security. Others counter that the economic stimulus resulting from the tax cuts will pay for the corporate tax cuts.

For ordinary Americans, the tax cuts under the new law are *not* permanent. But the law does lower many individual rates. The law keeps seven tax brackets, set at 10, 12, 22, 24, 32, 35 and 37%. (By comparison, the 2017 rates are 10, 15, 25, 28, 33, 35 and 39.6%.) The new rates will expire in 2025, unless Congress extends them or makes them permanent.

So what are the 2018 tax brackets for educators? As in the past, it depends on your taxable income and filing status. Salary.com reports the 2018 median annual salary for a public school teacher is $54,980, with a range of $48,000-63,475. As outlined in Title I of The Tax Cuts and Jobs Act (*https://goo.gl/5V2F29*), the new rates on taxable income (not salary) are shown in the table.

The new law almost doubles the standard deduction but eliminates the personal exemption.

Taxpayers have two basic options for filing a tax return: Itemize deductible expenses or take the standard deduction. According to the Internal Revenue Service, about 70% of taxpayers take the standard deduction, either because doing so makes the most sense financially, or because it's less complicated than itemizing tax deductions.

For 2017, the standard deduction was $6,350 for single tax filers and $12,700 for married couples filing jointly. The new law nearly doubles the standard deduction: $12,000 and $24,000 respectively.

A key question will be: Do deductible expenses exceed the higher standard deduction? If so, itemizing may be the best, albeit more complicated, path.

Congress also eliminated the $4,050 personal exemption you could claim for yourself, your spouse, and each dependent, which often reduced taxable income. Many experts predict this will significantly reduce or even eradicate the tax relief many Americans will realize from other aspects of the new law.

Experts also predict that the percentage of filers itemizing their taxes will drop sharply given the higher standard deduction and the significant changes to itemized deductions.

Teachers retain a modest supplies deduction.

Speaking of itemized deductions, one is exclusive to educators. Many teachers spend hundreds—and even thousands—of dollars of their own money annually on classroom supplies. Despite contradictory efforts to remove and expand the existing tax deduction that provides some relief to teachers, lawmakers kept the $250 deduction. If you spend money on supplies, this may be a deduction to claim if you're not doing so already. TurboTax offers tips on how to deduct the cost of classroom supplies in compliance with the law at *http://intuit.me/2EY4iS7*.

State and local tax deductions are capped.

In addition, taxpayers may be less likely to itemize their taxes due to significant changes to the state and local tax (SALT) deduction. The SALT deduction historically has been a sizable deduction for taxpayers, but now is capped at $10,000 under the new law.

This change could be substantial for Americans living in high tax states like New York and California. For example, if your combined property and state income tax is $20,000, only half ($10,000) would be deductible under the new law.

The mortgage interest deduction has been lowered.

Lawmakers retained the popular mortgage interest deduction, but set a lower limit. Historically, taxpayers could write off the interest paid on loans of up to $1 million. The new law lowers the amount to $750,000 for a newly-purchased home. And current homeowners have good news: They are grandfathered into the 2017 rate and will not be affected by the lower cap.

This new mortgage threshold could make it harder for those living in expensive areas like San Francisco and New York City to afford a home. And some experts are concerned that the change might prevent Americans from selling their homes and put downward pressure on home prices.

Clearly, this mortgage provision and the SALT deduction could have profound impacts on Americans' decisions about where to live.

Health care deductions remain, but the individual mandate was repealed.

The provision that allows taxpayers with high medical costs to reduce their taxable income by deducting some out-of-pocket medical expenses was a contentious issue as the tax bill was under consideration. The new law not only retains the deduction, but expands it.

Specifically, taxpayers with unreimbursed medical expenses that exceed 7.5% of their adjusted gross income can claim a deduction for those expenses in 2017 and 2018. The previous threshold had required that medical expenses exceed 10% of income to take the deduction in 2017 for those younger than 65. In 2019, the threshold will return to 10%. For taxpayers ages 65 and older, the threshold already was 7.5%.

However, experts warn that few Americans will be able to claim this de-

duction because their medical expenses are too low. For many workers, their largest medical expense is their health insurance premiums, which are typically paid with pretax dollars and cannot be deducted as a medical expense.

For Americans lacking employer-provided health insurance, the new law also eliminates the so-called individual mandate under the Affordable Care Act (ACA). The nonpartisan Congressional Budget Office predicts that 13 million fewer Americans will have health insurance coverage by 2027 as a result of the new tax law, and premiums for Americans enrolled in an ACA plan are expected to rise about 10%.

Student loan deductions are preserved.

Educators often have large student loans. According to Student Loan Hero, Americans owe more that $1.48 trillion in student loan debt, and the average 2016 graduate has $37,172 in student loan debt, up 6% from last year.

The new law keeps the student loan interest deduction. This allows those repaying student loans to reduce their tax burden by as much as $2,500 a year, and is available to anyone paying interest on education debt. This deduction can be claimed even if you are not itemizing deductions. However, only single people earning less than $80,000 and married couples earning less than $160,000 are eligible.

These are just a few of the highlights of the massive law. Many more changes will occur. For example, alimony payments and moving expenses are no longer tax deductible.

Consider this column as a motivator to start thinking *now* about your tax strategy. If you haven't itemized in the past, consider if it makes sense to do so, or if the standard deduction approach is a smarter financial decision. It may be prudent to consult a tax professional or accountant to look at your personal situation and recommended strategy. But alas—tax preparation fees are no longer deductible under the new law! ●

Kelly Kenneally has 25 years of public policy experience, including serving in the White House. She has worked for more than 10 years with nonprofit organizations to help improve Americans' financial security.

Quotable

A garden is a grand teacher. It teaches patience and careful watchfulness; it teaches industry and thrift; above all, it teaches entire trust.

—Gertrude Jekyll, British horticulturalist (1843–1932)

Breakout Boxes, from pg 1

lots of red herrings [distracting clues] that students needed to figure out," providing an additional challenge.

The game was "a great break from the more routine activities in the classroom. I even dressed up as an FBI agent," Reich recalls. "It is a good supplement, but I wouldn't teach solely with the game. [It provided] a good introduction to a unit and review."

"I did it as a schoolwide biology review for our state assessment," says Leah Barton, biology teacher at Norfolk County Agricultural High School in Walpole, Massachusetts. "I had different rooms with various activities, and one of the rooms was an escape room."

Barton says she gave the students "a fake news article that said I had stolen all the MCAS [Massachusetts Comprehensive Assessment System] exams" and told them the first clue for finding them was "hidden in a folder marked 'MCAS Tests,'" which contained a puzzle they had to solve. Students then used their completed puzzle to reveal a message written in baking soda that would provide the combination to a safe, and decoded DNA strands to find the key to a suitcase, which contained "a bag of goodies, candy and cookies," Barton explains.

"[It was] lots of work [for me], but by far [the students'] favorite. Students were coming up and thanking me and saying how fun it was," she reports.

"We currently have a digital breakout just about every other unit, and we keep adding to this," says DianaLyn Perkins, grades 6–7 science teacher at Coppell Middle School East in Coppell, Texas. "We have used them for introductory activities, formative assessments, and unit reviews…I want students to see that science can be fun and engaging," she explains.

With initial help from her school's technology specialist, Perkins and her team learned to use Google sites and forms to create digital breakout games for teaching about energy, chemistry, ecology, and lab safety. She contends the games "are not just about science content, but also about problem-solving skills…I've yet to do it where every student breaks out, [so it teaches students] resilience skills. They may be disappointed, but they learn it's okay to fail."

In addition, the games allow her to "see who is struggling and what they're struggling with," she maintains. "They can't break out if they don't know [the content]. It's easy to see their misconceptions."

Perkins doesn't grade students on the breakouts, but students can earn Experience Points (XPs) for their participation. "They're very engaged and competitive…They want their XPs," she reports. "I've had students who didn't break out in class, but took the initiative to do so at home."

Running the Games

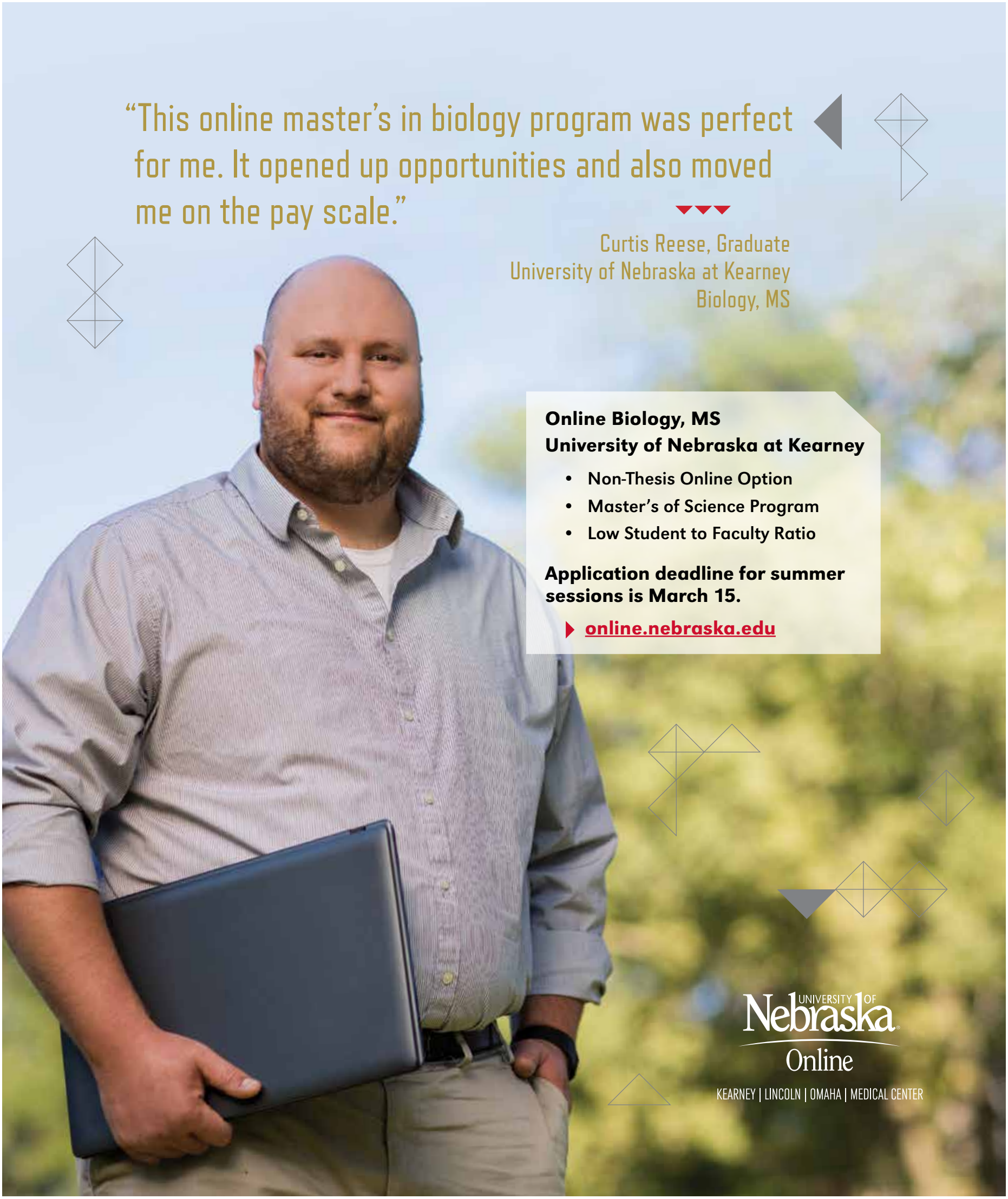
"My process is typically to come up with a topic, and then to start building a story around that topic. As the story develops, I create puzzles that support the plot," says Noah King, elementary technology specialist for Livermore Valley Joint Unified School District (LVJUSD) in Livermore, California. "Sharing digital breakouts [see some at *https://goo.gl/TwtF7P*] with the teachers I work with, and coaching them on how to use the breakouts with their students…[helps them embed] technology into what they are already teaching."

"The biggest challenge to running a science breakout isn't finding resources, but finding time," asserts Michelle Seugling, LVJUSD elementary technology specialist/coach. "In general, games are designed with a 45-minute timer…[and also include] the pre-activity talk [and] the debrief. Resetting the game also takes about 10 minutes on average (and this needs to be done in a student-free classroom)."

To save time, Seugling advises teachers not to hide clues in the classroom and to run the games in small groups. When students in upper grades have finished, she recommends "put[ting] them in charge of reorganizing the materials and resetting the locks for the next group," if they can be trusted to do so.

"You need to save a copy of the answer key, and make sure that the lock is not reset to another combination before it is put back onto the box," so the next group of student players can open it, Goodwin advises.

Most important, teachers should ask students not to "share the answers to the game with anyone outside the class, so as not to ruin the activity for those who have not played yet," Seugling urges. ●


“This online master’s in biology program was perfect for me. It opened up opportunities and also moved me on the pay scale.”
Curtis Reese, Graduate
University of Nebraska at Kearney
Biology, MS
Online Biology, MS
University of Nebraska at Kearney
• Non-Thesis Online Option
• Master’s of Science Program
• Low Student to Faculty Ratio
Application deadline for summer sessions is March 15.
online.nebraska.edu
University of Nebraska Online
KEARNEY | LINCOLN | OMAHA | MEDICAL CENTER

Educators Reflect on Their Science Methods Courses

NSTA Reports recently asked science educators to share the most important thing they learned in their science methods class during their preparation to become teachers. Respondents cited how to reflect on and assess their teaching (18%) and how to plan standards-based units (16%) were among the most important things from the class syllabus that they learned in their undergrad science methods courses, but more found other things from the syllabus more important, including how to engage and inspire students, the importance of lab safety, common misconceptions and strategies for addressing them, and how to incorporate scientific inquiry into lessons. Sadly, one respondent noted, "My class in no way prepared me to be a science teacher."

Here's what science educators are saying about what they learned (and what they wished they had) in science methods courses:

What did you learn later as a teacher that you wish had been included in the methods course(s)?

How to offer alternative assessments. —*Educator, Middle School, New York*

How to react to students. When I learned it was students that I was teaching and not a subject matter, I begin to focus on their needs and how to [meet] them.—*Educator, Middle School, High School, Institution of Higher Learning, Ohio*

How to prepare, organize, and safely execute facilitating a lab. It is a skill that you're expected to do, but haven't been explicitly trained in.—*Educator, High School, Massachusetts*

Usable classroom management methods: The books have all sorts of explanations for the types of management, but only seeing working methods in action lets you learn them.—*Educator, High School, Florida*

More examples of formative assessments and how to build better summative] assessments. Also, grading strategies. Everyone expects you to know how to grade assignments, and there are a lot of different ways to go about it, especially when you're giving different types of assignments. —*Educator, High School, Indiana*

Lab safety, how to set up/organize a stockroom, waste disposal, Modeling instruction, long-range planning, keeping student notes brief, using a variety of teaching strategies each hour, how to contact parents and get them on your side.—*Educator, High School, Michigan*

How to manage small-group science exploration in the classroom. —*Educator, Elementary Georgia*

How to handle students who do not read on grade level.—*Educator, Middle School, Connecticut*

What Was the Most Important Thing (on the Class Syllabus) That You Learned in Your Undergrad Science Methods Courses?

Strategies for integrating more than one science discipline into lessons	9%
How to incorporate other subjects (such as English language arts, math, or social studies) in science lessons	6%
Assessment strategies	7%
How to plan standards-based units	16%
Tactics for working collaboratively with colleagues	1%
How to reflect on and assess your teaching	18%
Differentiated instruction strategies	7%
Other	36%

Everything: How to deconstruct a standard and reconstruct it into a standards-based lesson. How to use standards to develop an assessment. How to use the 5E model of instruction. High-yield instructional strategies. The importance of collaboration between teachers.—*Educator, High School, Florida*

While we did a lot on differentiation, it often focused on having remediation opportunities for struggling students. There was very little (or nothing) included on extending activities for gifted/advanced students.—*Educator, Middle School, Georgia*

That you have to have much more knowledge than what is required to teach effectively. The more depth of knowledge you have, the better you are at being able to explain concepts in multiple ways and answer questions about why.—*Educator, High School, Ohio*

Where to get the background knowledge necessary to support science instruction, and understanding the difference between a curriculum and program of science.—*Other, Elementary, Connecticut*

How to create an entire coherent curriculum, not just single isolated units. How to ask questions and plan activities [that] put students at the center of the classroom.—*Administrator, High School, Illinois*

How to create and implement project-based units.—*Educator, High School, Virginia*

It would have been useful to think in terms of lesson arcs—connecting goals with outcomes, and then building tasks/activities that would provide the opportunity for my students to make progress.—*Educator, High School, New Jersey*

How to efficiently incorporate labs—setup, prep, presentation, cleanup, and lab reports—in my weekly classes. —*Educator, Elementary, Middle School, California*

Differentiated instruction strategies that allowed many senses to be involved.—*Educator, Middle School, Mississippi*

How to give constructive feedback to students in a way that doesn't give the answer.—*Educator, High School, California*

How to create assessments that included facts and problem-solving skills in a relevant manner.—*Educator, Middle School, New York*

What Wasn't on the Planned Curriculum?

That hands-on science teaching works and requires an enormous amount of preparation to do it well.—*Educator, Middle School, New York*

How to be able to admit I didn't know something, and still be confident. —*Educator, Elementary, Middle School, High School, Institution of Higher Learning, Informal Education Setting, Virginia*

To start the lesson with a question and let the students find the answer. —*Educator, Elementary, Georgia*

How to pace a lesson, how to plan for varied lengths of instructional time (45 minutes or block).—*Other, Institution of Higher Learning, New Jersey*

Collaboration with other teacher-candidates—*Educator, Middle School, Rhode Island*

What resources to use if you are teaching a unit/course outside of your discipline.—*Administrator, Middle School, Maryland*

To network, and to be really, really nice to the custodians and to the secretaries. They rule the education world! —*Educator, Middle School, Missouri*

How dealing with kids' emotions and interactions with you and their friends affects how they think about science. And how one bad score makes them "hate science" and you because you "gave" them that grade.—*Educator, Middle School, Nebraska*

Something I learned along the way was how important it is to be able to write clearly (and neatly) about your procedures, etc.—*Educator, Elementary, California*

How to copy/steal/borrow/adapt lessons from other teachers to match your style.—*Administrator, High School, Arizona*

How to do action research.—*Educator, High School, Ohio*

The background knowledge necessary to understand the science we were teaching.—*Other, Elementary, Connecticut*

I learned how to be successful at failing and realizing that F.A.I.L. is the First Attempt In Learning.—*Educator, Middle School, California*

How to apply for jobs.—*Educator, High School, Virginia*

How to teach authentic science. My methods course just introduced me to a bunch of different labs in different content areas.—*Educator, High School, Institution of Higher Learning, Michigan*

The most important, noncurriculum lesson was to research and ask questions until understanding is accomplished.—*Educator, High School, Institution of Higher Learning, Mississippi*

The amount of work outside of the actual class time.—*Educator, High School, California*

Teaching writing as part of the science curriculum. With *Common Core,* it is really important to teach the strong, expository three-paragraph essay in science.—*Educator, Elementary, Middle School, California*

I learned that I can't force my students to try something that they don't want to. (I brought in my Madagascar Hissing Cockroaches as one of my practice lessons, and I kept [insisting to] my classmates that it's okay to touch the bugs, not realizing that I was pressuring them too much.)—*Educator, High School, New Jersey*

Science is everywhere, and its relevance makes it an integral part of basic and advanced curricula.—*Educator, Middle School, Institution of Higher Learning, Illinois*

Content. I understand that there is a science teacher shortage, but many preservice science teacher preparation programs do not have enough content.—*Educator, High School, Missouri*

That everyone's experiences in life are different and to have empathy. —*Educator, Middle School, High School, Texas*

How to use the components of various science teaching methodologies to create lessons that hooked my students. —*Educator, Middle School, New York*

The importance of recognizing each student as an individual.—*Educator, High School, New Jersey* ●

Learn and Connect at NSTA's Atlanta Conference

Educators attending NSTA's National Conference on Science Education in Atlanta, taking place March 15–18, will be treated to informative sessions on important topics, many grouped along strands on 3-D learning; science, technology, engineering, and math (STEM); literacy and science; and science access for all students. "The conference offers an amazing opportunity for teachers to collaborate and grow professionally in terms of their own learning and professional network," says Zoe Evans, conference chair and NSTA District V Director. "Atlanta has so much to offer, [including] cultural experiences and things to see while not in conference."

Keynote speaker Ron Clark will have much to say about the strand Reflecting on Access for All Students. Clark, who founded Atlanta's Ron Clark Academy, will share his experiences teaching in two vastly different environments: a low-wealth rural area in North Carolina and inner-city Harlem in New York City. His presentation, Teaching Through Adversity: Facing Challenges and Making a Difference, will feature his fascinating curriculum based on worldwide travel and examples of award-winning projects his students conducted, both of which transformed his students from disinterested to motivated and inspired.

Featured presenter Stephen Pruitt will shed light on the Focusing on Evidence of 3-D Learning strand. Before his current position as Commissioner of Education for the Kentucky Board of Education, Pruitt coordinated the development of the *Next Generation Science Standards* (*NGSS*) during his tenure as senior vice president at Achieve, Inc. Whether or not your state has adopted the standards, you'll appreciate his presentation on 3-D Science Assessment: How Do You Still Make Construction a Priority? Pruitt will illustrate how three-dimensional learning allows students to connect science to their everyday lives and helps prepare them for future careers.

Two special, free events also will feature 3-D learning. This year's NGSS@NSTA Forum on March 16 focuses on instructional materials. The opening session, which describes tools to evaluate resources, is followed by five separate sessions highlighting instructional units designed to address 3-D standards. The NGSS@NSTA Share-a-Thon on March 17 will have even more tips and tools to implement 3-D standards from NSTA's *NGSS* Curators, *NGSS* writers, and other education experts. Don't forget to take home the handouts from the Share-a-Thon!

The strand Imagining Science as the Foundation for STEM will feature sessions on escape rooms, tiny homes, robots, citizen science, and ocean technology, among other current topics. Find out how STEM instruction that builds on the foundation of core science ideas gives students opportunities that equip them to make sense of the world in which they live, hone their critical-thinking skills, and spark their sense of innovation.

The strand Comprehending the Role of Literacy in Science will enlighten educators about how science core ideas can be developed by using current technology and media to create, refine, and collaborate through reading, writing, listening, and speaking. Sessions in this strand will include Exploring the Science of Sound, Engineering for the *Gingerbread Baby,* and Surviving the Zombie Apocalypse.

Making Connections

Discover high-quality out-of-school (informal) science education methods, resources, and opportunities to enhance science teaching and learning during the Community Connections Forums. In-school and out-of-school science educators will network and share best practices in informal science, learn about collaborations among informal and formal science organizations, and discuss ideas and innovations. Participating informal educators come from zoos, museums, media, after-school programs, university outreach efforts, and other venues.

Remember Fredi Lajvardi, the STEM educator from the documentary *Underwater Dreams* and film *Spare Parts?* Lajvardi will be a panelist and presenter at the Community Connections featured presentation and panel Spare Parts: Re-Inventing Engineering Education for the 21st Century. Hear his inspiring story, and connect with him and other engineering educators and engineers at this event.

MIKE WEISS

If Atlanta is your first NSTA conference, you can connect with other "newbies," as well as NSTA Board and Council members who can help you make the most of the conference, at the First-Timer Conference Attendees' Orientation on March 15. Those who haven't attended a conference in a while can check out what's new and different.

On March 16, the Elementary Extravaganza and Meet Me in the Middle Day will have elementary and middle level educators networking, learning about resources and opportunities, and hearing presentations designed especially for them. Both events offer chances to win door prizes!

Representatives from hundreds of science education companies will be in the Exhibit Hall, many conducting cool demonstrations or offering opportunities to try out a new product.

Additional Opportunities

Professional Learning Institutes (PLIs)—content-based programs that explore key topics in science/STEM education in depth—take place on March 14 and require preregistration. This year's PLIs are

- District-Level Administrators: You Are the Fourth Dimension in Implementing 3-D Teaching and Learning!;
- Next Generation Analyzing Instructional Materials (NextGen AIM);
- Connecting STEM Education to the Workplace;
- STEM Curriculum Topic Study: A Process for Linking Standards, Research, and Learning; and
- Picture-Perfect Powerful Practices: STEM and Literacy Integration.

A free Shell One-Day Institute, Embracing an Equitable Mind-set: Developing Culturally Proficient Leaders, is for educators who want to lead efforts to ensure high success for all students. Completion of a survey is required after conference registration.

Full-time K–12 teachers of science, technology, or engineering working within a 100-mile radius of Atlanta are eligible for a free PLI ticket. Learn more at *www.nsta.org/conferences/pli*.

Attendees can also register for short courses on a variety of topics, including 3-D learning, climate change, STEM, and engineering; and for educational trips, such as Stones and Stories: A City Earth Science Walk.

For more information about the Atlanta conference and to register, visit *www.nsta.org/atlanta*. To access the conference app and use your mobile device to view sessions and create a personalized schedule in early March, see *www.nsta.org/conferences/app.aspx*. ●

PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies page G1

News Bits page G3

What's New page G4

In Your Pocket page G7

Summer Programs page G8

Freebies for Science Teachers

Andover Fulcrum Online Teacher Resource Center. K12 At this website, K–12 educators can access and share standard-supported content showcasing best practices used in classrooms nationwide, including their own. The resources address core subject areas, including science; span grade levels from elementary to high school; and include worksheets, lessons, videos, and group activities. Search the database by subject, resource type, grade level, keyword, or learning standard. (Free registration is required to download the resources at *www.Fulcrum.AndoverEd.com*.)

CS CALIFORNIA

bioGraphic for Educators. M H Infographics, data visualizations, and videos at *https://goo.gl/rfvEWz* make great interactive learning resources for middle and high school students and science teachers. Produced by *bioGraphic,* the California Academy of Science's multimedia magazine, the resources highlight plant and animal survival strategies observed in nature and promising approaches to sustaining life on Earth. Learn from a bumblebee's flight in the video *Bumper Bees;* discover how giant sequoia trees transport nutrients from root to crown in the infographic The Making of a Giant; or read leveled news articles highlighting current research on the behaviors of dolphins, crested guan, green sea turtle, alpine frog, and other animals.

Indicators for Monitoring Undergraduate STEM Education. HE Though many current initiatives aim to improve the quality and impact of undergraduate science, technology, engineering, and mathematics (STEM) teaching and learning, little concrete data exists about whether these initiatives are actually improving undergraduate STEM education nationwide. The National Academies of Sciences, Engineering, and Medicine recently published a report that establishes a set of national-level indicators to measure the status and quality of undergraduate STEM education over multiple years. These indicators include instructors' use of evidence-based STEM practices in and out of the classroom; student retention in STEM programs from course to course and from year to year; and the numbers of individuals attaining STEM credentials over time.

The report also states that to use the indicators, additional data must be collected about student demographics, instructors' use of evidence-based teaching approaches, and student transfer patterns. Download the report at *https://goo.gl/GhGNMm*.

The Waystation Network. K12 K–12 students and educators of all ages interested in Monarch butterfly migration will appreciate this website. Created by Monarch Watch.org, the site provides support for schools and educators with pollinator gardens or who want to incorporate a study of monarchs into the curriculum. Find curriculum, gardening tips, background information on monarchs and other insects, monarch-related Student Challenges to spark classroom discussion, and DirectAction steps to take for monarch conservation. Visitors to *https://goo.gl/Euafvm* can also read the Waystation blog and register for a project newsletter.

Physics in Your Future. M H Inspire girls in grades 6–12 to pursue physics careers with this booklet from the American Physics Society at *https://goo.gl/xUf2v3*. The booklet conveys the diversity and excitement of physics through profiles of women working as a nuclear physicist, science writer, business entrepreneur, biophysicist, data scientist, astrophysicist, science educator, and in other positions. The profiles show how a physics background can lead to a variety of fulfilling careers in science. Share the booklet in science classrooms as well as with parents, guidance counselors, and other community leaders interested in informing young women about science careers.

A Guide to the Energy of the Earth. H In this animated lesson produced by TEDEd Originals, educator Joshua M. Sneideman examines the many ways in which energy cycles through our planet, from the Sun to our food chain to electricity and beyond. Targeted for grades 9–12, the lesson is divided into four sections: Watch, which presents the animated video content; Think, which offers a set of 10 open-ended and multiple-choice questions on the topic; Dig Deeper, which highlights additional web resources about energy; and Discuss, which enables students to share what they've learned or ask questions in an online forum. Find this

See Freebies, pg G2

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

Freebies, from pg G1

lesson and other TEDEd Originals at *https://goo.gl/dcVW4z*.

Next Generation Science Assessment (NGSA) Resources. M The NGSA Collaborative—a multi-institutional group of education researchers and technology developers from the University of Illinois at Chicago, SRI International, Michigan State University, and the Concord Consortium—has developed classroom-ready online assessment task sets in physical and life sciences for grades 6–8. The interactive online assessments feature videos and simulations, authentic scenarios, drawing tools, and scaffolds and can be used during instruction to garner good evidence that students are building proficiency with the *Next Generation Science Standards* (*NGSS*) performance expectations. The physical science assessment task sets address the topics Chemical Reactions and Energy; the life science assessment task sets address the topics Photosynthesis, Biological Transformations of Matter and Energy, Ecosystem Interactions, and Transfer of Matter and Energy in Ecosystems. Learn more and preview the task sets at *http://nextgenscienceassessment.org*.

JEF POSKANZER

Engineering Everywhere. M If you need content for an after-school science program, check out Boston Museum of Science's Engineering Everywhere curriculum for grades 6–8. Ten hands-on activity–filled curriculum units let students tackle real-world engineering problems using the Engineering Design Process, along with creativity and collaboration. Explore agricultural engineering in Vertical Farms, or learn about biomechanical engineering achievements like bike safety helmets and fish prosthetics in units such as Put a Lid on It and Go Fish. In Outbreak Alert! (biomedical engineering), students investigate pandemic response, while in It's in the Bag (materials engineering), students design gear inspired by nature. Other units include It's About Time (timers/mechanical engineering), Plants to Plastics (bioplastics/chemical engineering), Don't Runoff (urban landscapes/environmental engineering), Here Comes the Sun (insulated homes/green engineering), and Food for Thought (ice cream/process engineering). See *https://goo.gl/DnV6sJ*.

***On Bird Hill* Educator's Guide.** E The book *On Bird Hill* (Yolen 2016) introduces K–2 students to the world of birds and shows them what happens when chicks hatch. An accompanying Educator's Guide and website produced by the Cornell Laboratory of Ornithology's BirdSleuth program presents interdisciplinary, standards-based activities to extend students' learning from the text. Reenact a chick's hatching with pantomime in Retellings and Reenactments; play Baby Bird Run!, a true/false tag game, to reinforce new bird understandings; create a realistic habitat for birds in Habitat Designers; learn about the diversity among bird nests in So Many Nests and Build a Nest; and feel a shell-less egg (an egg soaked in white vinegar) in Bouncing Baby Bird. The website provides background information, digital content, and supplementary activities to complement the printable guide. Visit *www.birdsleuth.org/obhbook*.

Chandra Learning Resources. K12 At *http://chandra.si.edu/edu,* explore X-ray astronomy in K–12 classrooms with education resources from NASA's Chandra X-ray Observatory. Chandra—a telescope specially designed to detect X-ray emission from very hot regions of the Universe, such as exploded stars, clusters of galaxies, and matter around black holes—has made many discoveries about our high-energy universe. Educators can access classroom activities, printable materials, and interactive games that bring the excitement of the Chandra mission and astronomy to students of all ages. Highlights include *Hot Stories of Cool Science: Star Birth Edition,* an e-book for elementary students; Modeling the Electromagnetic Spectrum, a set of activities for middle and high school students exploring the limits and benefits of using models in science; and interactive quizzes on the Chandra Mission and General X-ray Astronomy for high school students.

Anchoring Phenomena for Middle Level. M Looking for help in shifting to *NGSS*–supported science instruction? Check out these real-world anchoring phenomena and supporting materials, developed by Vermont educator Wendy Moore for seventh- and eighth-grade physical and life science units. The anchoring phenomena—which reflect a range of resources including still images, video clips, demonstrations, and student investigations—are the foundation for *NGSS*–supported units in Forest Ecology, Light and Color, Evolution by Natural Selection, Static Electricity, Air Pressure/Phases of Matter, Density, Photosynthesis, and more. See *https://goo.gl/ERG22A*.

AAPT eMentoring. K12 The American Association of Physics Teachers (AAPT) offers an online mentoring program to connect new physics teachers with physics teachers who are familiar with the available resources and how and when to use them. Novice teachers also can access an Instant eMentor if assistance is needed within 24 hours. To learn more and participate as a mentor or mentee, visit *http://ementoring.aapt.org*.

JAMIE LANTZY

Feed the World Curriculum. H The Ohio Corn and Wheat Growers Association offers learning modules for high school students that explore topics in agriculture, such as biotechnology in farming, energy and ethanol, limits of food production, soil and sustainability, and water quality. Each module centers on a guiding question and includes teacher background, downloadable lessons, and digital extras (e.g., related videos, handouts, and information about careers in the field). Visit the website *https://goo.gl/F3QvSL*.

STEMRobotics. K12 HE Portland State University's online repository for robotics educational materials is for K–12 teachers, after-school program coaches, college/university faculty, students, and parents interested in learning or teaching about robotics, including computer science. The site features complete curricula (with lessons, assessments, instructor guides, and more) and individual resources (e.g., videos, lectures) to guide robotics use in the classroom or home. Many resources involve the LEGO Education materials; for example, a search of the keywords "LEGO MINDSTORMS" generated more than 1,000 hits, highlighting everything from tutorials to videos. The site features links to other organizations with robotics resources, including several offering opportunities for students to compete in robotics tournaments. See *http://stemrobotics.cs.pdx.edu*.

Carbon: Transformations in Matter and Energy (CTIME) curriculum. M H Created as part of the CTIME project—a collaborative effort of scientists, teachers, graduate students, and IT specialists to refine K–12 frameworks and assessments for learning progressions that lead to environmental science literacy—these *NGSS*–supported teaching units for middle and high school science levels focus on processes that transform matter and energy in organisms, ecosystems, and global systems: combustion, photosynthesis, cellular respiration, digestion, and biosynthesis. Four units—Systems and Scale, Plants, Animals, and Decomposers—examine matter and energy in flames and individual organisms. The Ecosystems and Human Energy Systems units address carbon and energy at ecosystem and global scales.

Each three-week unit includes formative assessments, hands-on investigations supported by videos, molecular modeling activities, animations and simulations of carbon-transforming processes and carbon cycling, posters, and graphic organizers. See the website *http://carbontime.bscs.org/units*. ●

News Bits

- **A New York City public middle school uses mobile technology to boost family involvement via Family Playlists.** M

At South Bronx Preparatory School, 95% of students qualify for free or reduced-price lunch, and their parents often work multiple jobs and are uncomfortable speaking English. But Family Playlists—initially provided to 100 sixth graders and now used by 180 students (including seventh graders)—has 91% of families participating.

Elisabeth Stock, head of local nonprofit PowerMyLearning, which created Family Playlists, said the program invites students to teach their families what they're learning in school. About once a week, a teacher creates a homework assignment with two parts. First the student does an assignment. Next, the student teaches the lesson to a family member through a project (e.g., by creating a map of their neighborhood). All the work happens via mobile devices.

Available for a yearly fee, Family Playlists has expanded to cities such as Los Angeles, Atlanta, and Washington, D.C. Read more at this website: *https://goo.gl/xH9rkG*.

- **Texas A&M University researchers hope to expand Making the Makers, a hands-on science, technology, engineering, and math (STEM) program that has increased students' science scores and interest in engineering at a Texas elementary school serving many children from economically disadvantaged families.** E

Researchers targeted about half of students in grades 3–5 at Neal Elementary School in Bryan, Texas, developing experiments for them based on their curriculum. The study aimed to pique interest in STEM, and according to Principal Juanita Collins, many students have said they want to be engineers. "Our kids would not have even known about that had they not had exposure to [Making the Makers]," she asserts.

With National Science Foundation funding running out for the pilot study, the researchers say they want to scale the project with $1.6 million in new funding from Texas A&M's colleges of liberal arts, engineering, architecture, and education. Malini Natarajarathinam, an associate professor of engineering, said that it's critical, especially for schools in low-income areas, that the lessons take place during the school day—not just after school or in summer programs. "This needs to be a constant immersive experience," she contends. Read more at *https://goo.gl/tivpZp*.

- **Unified School District in Fresno, California, is experimenting with Strides, an app that tracks students' data (e.g., attendance, grades, after-school activities) and lets them view it.** E M H

Strides is used by 58,000 students in grades 2–12. Early data suggests that students who log in at least twice a week have improved attendance and grades. And Strides' leaderboard feature, which shows students (anonymously) where they fall in relation to their entire school, has a social component that lets them connect with peers.

However, teachers and administrators are concerned that students with lower scores might lose motivation. Paul Scott, software development team coordinator, says Strides gives students multiple ways to earn points, and uses positive reinforcement so students won't opt out. Read more at the website *https://goo.gl/1S7McK*. ●

What's New

FROM U.S. GOVERNMENT SOURCES

National Aeronautics and Space Administration (NASA)

NASA Science Toolkits K12

Need downloadable space resources for your classroom? NASA Science Toolkits have digital resources (posters, websites, and more) for K–12 educators and space aficionados of all ages. The kits cover topics from planetary missions to heliophysics. All toolkits include resources featuring space images and illustrations from NASA, but of particular interest are the 2018 Astronomy Picture of the Day Calendar and the Earth Day Posters series, which has posters from past Earth Days, 2010–2017.

The toolkits are color-coded by topic (e.g., Universe, Solar System, Sun, Earth, Missions, All Science) for quick reference. Visit *https://science.nasa.gov/toolkits.*

Moon Rocks and Meteorite Samples K12 HE

K–college educators can borrow samples of Moon rocks and meteorites from NASA. Visit the Astromaterials Samples for Education site at *https://goo.gl/PDjcFs* to learn how. The loan for K–12 teachers (in U.S. schools only) includes a clear, acrylic disk containing six samples of either Moon rocks or meteorites, written and graphic descriptions of each sample in the disk, a PowerPoint presentation on CD, a teacher workbook, and additional printable material.

Instructors at colleges and universities with a curriculum in the geosciences can borrow a Petrographic Thin Section Package containing 12 polished thin sections of samples from either the Lunar or Meteorite collections. Each set of 12 slides is accompanied by a sample disk of representative lunar or meteorite samples, embedded in acrylic disks suitable for classroom use, and teaching materials. The loan period for any sample is two weeks.

Jet Propulsion Laboratory Resource Database K12

Bring the wonder of space to your students with the education resources from NASA's Jet Propulsion Laboratory. At *https://goo.gl/cuKNmm,* educators can access a searchable database containing K–12 science, technology, engineering, and math (STEM) activities and resources, from an innovative classroom activity like the board game Marsbound! Mission to the Red Planet to the How to Do a Science Fair Project video series. Select parameters such as resource type, subject, grade level, and topic to view the resources that best fit your classroom's needs.

National Science Foundation (NSF)

Human Water Cycle Video Series M H

NSF and NBCLearn have created a four-part video series about the Human Water Cycle. Of interest to environmental educators of any level but most appropriate for middle and high school classrooms, the short, newsy segments

(about five minutes) highlight scientists developing new ways to meet our water needs and show connections among water, food, and energy.

The first episode, *Water, Food, and Energy,* introduces the human water cycle: the idea of water as a vital resource for humans that powers homes, hydrates bodies, irrigates crops, and processes waste. The second episode, *Drinking Water,* examines emerging technologies that are improving the drinking water purification process. *Agriculture,* the third episode, looks at scientists' efforts to monitor the salinity level of soil to help farmers make better decisions about water use. The final episode, *Wastewater,* reports on the changing perception of wastewater because it is treated more efficiently and energy is being created from resources in it. Watch the videos at *https://goo.gl/7E5W4w.*

National Oceanic and Atmospheric Administration (NOAA)

Planet Stewards Book Club A

Check out the books and topics educators are suggesting and discussing as part of NOAA's Planet Stewards Book Club meetings. Open to educators of all ages and levels, the book club selections cover a range of topics relating to understanding and protecting our environment, from nonfiction titles like *Betting the Farm on a Drought* by Seamus McGraw, which reflects on the impacts of climate change on our nation's farmers and ranchers, to the birth of a new genre in literature—cli-fi (climate fiction)—which, with its ability to bridge science with the humanities and activism, is helping to make environmental issues more accessible to high school and college readers. Each book or topic train includes links to resources and guiding questions for discussion.

Want to move beyond recommendations? Interested teachers can also register to participate in future book events. Club meetings usually occur on the last Monday of the month at 8 p.m. Eastern Time. Consult *https://goo.gl/GK7bWK.*

United States Geological Survey (USGS)

Water Properties and Measurements M H

Middle and high school teachers and students can gain a deeper understanding of water and its properties through these education resources from the USGS's Water Science School at *https://goo.gl/CsTBwz.* Organized by category—Water Properties, The Water Around Us, Chemical Properties, The Water Cycle, and Water Science Activities—most of the material provides background information explaining concepts such as capillary action, surface tension, conductivity, hardness, condensation, and evaporation. The articles within each category are hyperlinked to other USGS resources for further exploration of the topic.

The Water Science Activities provide opportunities for students to reinforce their knowledge of water through true/false quizzes on groundwater and water properties. Students can also share their opinions on water issues through surveys (e.g., What is the biggest water problem of the future? How would you fix a water shortage?), challenge questions (e.g., How much water does a dripping faucet waste?), and water-use questionnaires (e.g., What is your daily home water use?).

National Park Service (NPS)

Junior Archaeologist Activity Book E

Encourage elementary students (ages 6–12) to take the pledge and become Junior Archaeologists! This activity book and parent guide contains more than 20 hands-on games and activities to help students understand what an archaeologist does and what can be learned by studying people and objects of the past. From inferencing (Time Capsule, Trash Can Archaeology), excavation practices (Let's Excavate), and stratigraphy (Stories from the Soil) to site chronology and context (Getting a Date, Puzzle Pieces) and archaeological ethics (Archaeology Matters, The Right Thing), the book offers a thorough, age-appropriate introduction to the science of archaeology.

Students ages 6–9 who complete at least 10 activities in the book, and older students (ages 10–12) who complete at least 20 activities can mail their completed books to the address provided and receive official recognition as Junior Archaeologists from National Park Service Archaeology Program headquarters. The accompanying parent guide includes discussion questions, extension activities, and suggestions for further reading. Download the book at *https://goo.gl/PgDQrQ.*

Department of Energy (DOE)

Operation Clean Desert M H

This set of activities follows the adventures of Dr. Proton and Adam the Atom as they lead a tour of the Nevada National Security Site and share its unique history and describe environmental cleanup efforts there. Most appropriate for middle and high school audiences, the resources—which include a student activity book and teacher's guide—address environmental challenges such as contaminated groundwater and radioactive waste disposal, caused by nuclear testing at the site.

The activity book presents a mix of cartoon illustrations and actual photographs of the site, along with facts about the site, scientific information, an experiment, word puzzles, and an atom activity. The teacher's guide is an annotated version of the student activity book; each page includes standards information, discussion points, and activities to deepen students' understanding of the content. Download the resources at *https://goo.gl/tW2x6p.*

Environmental Protection Agency (EPA)

Lead Blockers Lesson Plan E M

In this EPA lesson, which has versions for elementary and middle levels, students learn about the health effects of lead, and in games, model how a healthy diet can minimize the absorption of lead in their bodies. In the K–4 activity, teams conduct a relay race to collect cutouts of foods and drink items (some healthy and some not-so-healthy). Teams sort their collected items into "healthy" and "not-so-healthy" piles, noting which items are lead blockers (i.e., the healthy food items). The relay team with the most healthy foods collected is the winner.

In the activity for grades 5–8, students play tag to model how certain nutrients (iron, vitamin C, and calcium) can minimize lead absorption. Students must follow the instructions on a teacher-distributed Tag Identification Card to learn how they can move during the game (e.g., "You ate French fries with lunch, stop every three steps for five seconds," "You ate an orange for a snack, run as fast as you can!"). Students who ate the healthier food survive longer in the game.

The lesson plan, available at *https://goo.gl/cEWbEj,* includes teacher background information, procedures, and assessment questions for both activities.

U.S. Department of Education (ED)

STEM Success for Hispanic Students H

A recent study from ED's Regional Educational Laboratory Southwest suggests that Hispanic students' completion of rigorous math and science courses in high school predicts their postsecondary success in STEM fields. For Texas public high school graduates enrolled in a two-year or a four-year college, indicators of academic experiences, achievement in math and science, and high school attendance rate were strongly associated with postsecondary STEM success. The associations were generally similar for non-Hispanic white students and Hispanic students. The indicators associated with postsecondary STEM success included number of math or science courses taken, number of Advanced Placement math or science courses taken, highest math or science course taken, and scores on state assessments.

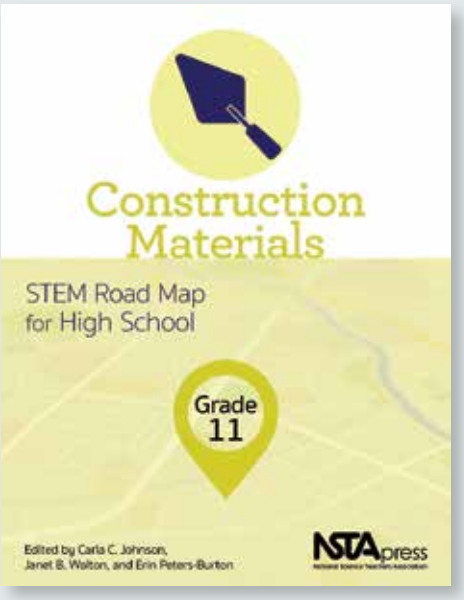
View the report summary as a PDF file or as an infographic at the website *https://goo.gl/YAjmAF.* ●

NSTA Press Authors and NSTA's National Conference on Science Education Combine for Great Professional Learning

Whether you're interested in learning how to use *Picture-Perfect Science Lessons* in your classroom, how to *Uncover Student Ideas*, how to integrate STEM teaching, or what's next in implementing *Next Generation Science Standards*, NSTA Press authors on these topics and many others will be in Atlanta for the NSTA Annual Conference, March 15-18, 2018. Learn more at *www.nsta.org/conferences/national.aspx*. We hope to see you there!

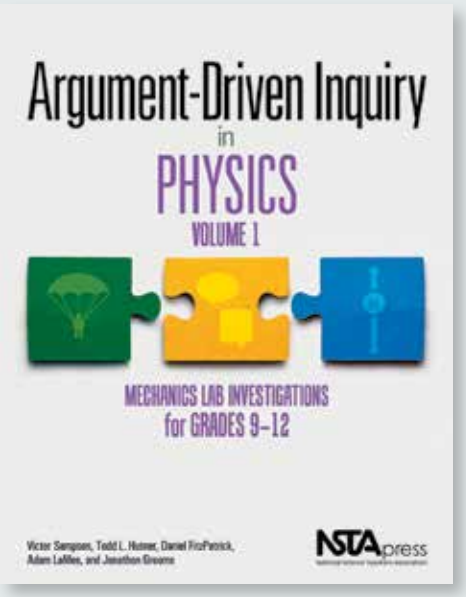
I love NSTA books they help to inspire me to be a better teacher.

–NSTA Press reader Mary H.



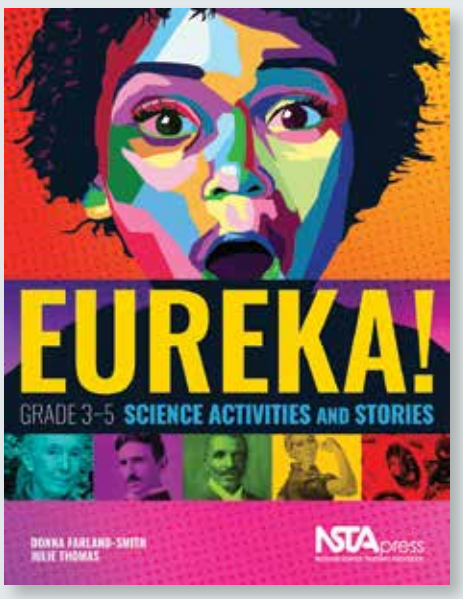
Grade 11

Book: Member Price: $18.36 | Nonmember Price: $22.95
E-book: Member Price: $13.77 | Nonmember Price: $17.21
Book/E-book Set: Member Price: $22.03 | Nonmember Price: $27.54



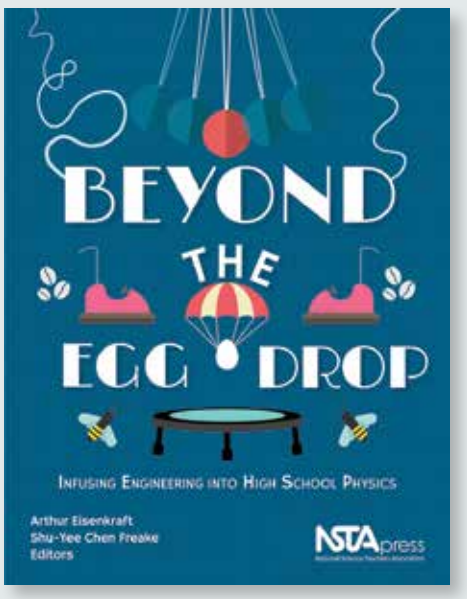
Grades 9–12

Book: Member Price: $35.96 | Nonmember Price: $44.95
E-book: Member Price: $26.97 | Nonmember Price: $33.71
Book/E-book Set: Member Price: $43.15 | Nonmember Price: $53.94



Grades 3–5

Book: Member Price: $31.96 | Nonmember Price: $39.95
E-book: Member Price: $23.97 | Nonmember Price: $29.96
Book/E-book Set: Member Price: $38.35 | Nonmember Price: $47.94



Grades 9–12

Book: Member Price: $35.96 | Nonmember Price: $44.95
E-book: Member Price: $26.97 | Nonmember Price: $33.71
Book/E-book Set: Member Price: $43.15 | Nonmember Price: $53.96

To place an order or download a free chapter, visit
www.nsta.org/store

NSTA National Science Teachers Association

In Your Pocket

Editor's Note

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

February 23–28

American Electric Power Teacher Vision Grants P K12

These grants go to preK–12 teachers who live or teach in American Electric Power (AEP) service areas in Arkansas, Indiana, Kentucky, Louisiana, Michigan, Ohio, Oklahoma, Tennessee, Texas, Virginia, and West Virginia. Grants of $100 to $500 fund projects with an academic focus that improve student achievement; those with an emphasis on science, math, technology, electrical safety, energy, or the environment are preferred.

Teachers who have attended an AEP Workshop for Educators, participated in the National Energy Education Development project, or are affiliated with an AEP school–business partnership receive priority. Apply by **February 23** at *https://goo.gl/76t9mv.*

Duke Energy Foundation K to Career Grants K12

These grants support science, technology, engineering, and math (STEM), reading proficiency, and workforce development in communities where the company operates: in Florida, Indiana, Kentucky, North Carolina, Ohio, and South Carolina. Grants are awarded to nonprofit programs that build STEM knowledge or critical-reading skills in schools, prepare STEM teachers, or provide students with out-of-school STEM opportunities. Apply online by **February 28** at *https://goo.gl/Sxunus.*

ISTE Outstanding Young Educator Award K12

The International Society for Technology in Education (ISTE) honors a teacher who is age 35 or younger as of July 15 and uses technology to improve teaching and learning. The awardee will receive free registration to the ISTE Conference and Expo, up to $1,000 in travel expenses, a $1,500 cash prize, and a one-year ISTE membership. Nominate yourself or a colleague by **February 28** at *https://goo.gl/W3nhkF.*

ISTE's Kay L. Bitter Vision Award P E

This award recognizes one preK–2 teacher who uses technology with students in innovative ways. The honoree will receive free registration to the ISTE Conference and Expo, up to $1,000 in travel expenses, and a one-year ISTE membership. Nominate yourself or a colleague by **February 28;** see *https://goo.gl/opkvQM.*

Monsanto Fund Education Grants K12

These grants support communities within 30 miles of Monsanto sites. Funds are available for K–12 schools, libraries, and farmer training or academic enrichment programs that focus on STEM or aim to improve basic skills in science, math, or reading. Programs should support underserved students and take place during the school day.

Applicants must first request an invitation code at *https://goo.gl/bsrDjU.* Apply by **February 28.**

March 1–15

Association of American Educators Classroom Grants K12

These grants of $500 or less fund a variety of classroom projects and materials, including books, software, calculators, audiovisual equipment, and lab supplies. Full-time educators who haven't received a scholarship or grant from the Association of American Educators (AAE) in the last 18 months are eligible. Teachers in Arkansas, Colorado, Idaho, Kansas, Oregon, and Washington compete for state-specific funds and complete a separate application. Apply by **March 1;** consult *https://goo.gl/eWCd5N.*

Dominion Energy Environmental Education and Stewardship Grants K12

These grants go to public and private K–12 schools and nonprofit organizations in areas Dominion Energy serves in Connecticut, Idaho, Maryland, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Virginia, West Virginia, and Wyoming. Grants of up to $50,000 are available for short-term environmental projects with measurable results; K–12 schools get up to $5,000. Projects should educate students about environmental stewardship, help protect and preserve natural habitats, or improve open spaces and make nature more accessible. Apply by **March 1;** visit *https://goo.gl/zMMjcm.*

Astronomical Society of the Pacific's Thomas J. Brennan Award H

Astronomical Society of the Pacific's (ASP) $500 award goes to an exceptional high school astronomy teacher who's committed to classroom or planetarium education and training other teachers. Colleagues and students can nominate any high school astronomy teacher, or an individual who has made an impact on high school astronomy teaching, in North America. The honoree will receive a check and a plaque at ASP's Annual Awards Meeting Banquet. Letters of nomination are due by **March 1;** visit *https://goo.gl/H9qRx9.*

Presidential Innovation Award for Environmental Educators K12

The Environmental Protection Agency (EPA) recognizes outstanding K–12 environmental education teachers. Up to two teachers from each of the EPA's 10 regions, in different states, will be chosen. Awardees receive $2,500 to further their professional development, and their local education organization receives $2,500 to fund activities and programs to support the teacher.

K–12 educators at public schools are eligible; applicants must have a current teaching license and at least five years of teaching experience, including three years of teaching environmental education. Apply by **March 1** at *https://goo.gl/f1t8AT.*

Get Out and Grow School Garden Sweepstakes K12

This contest is open to school gardens that encourage hard work and healthy eating. One gold prize winner will receive $15,000 for a new or improved school garden and a visit from a TEAM USA Olympic athlete; a silver winner will receive $5,000; and 20 bronze winners will get $500. School administrators and food service directors at K–12 schools are eligible. To enter, go to *https://goo.gl/3r8K9Y* and explain in 250 characters or fewer why a new or improved school garden would benefit your students. Enter by **March 11.**

Braitmayer Foundation's K–12 Education Grants K12

The foundation provides these grants for innovative practices in K–12 schools. Of particular interest are curricular and school reform initiatives and professional development opportunities for teachers, especially those that encourage people of high ability and diverse backgrounds to enter or remain in the profession. Grants of up to $35,000 are available.

A proposed budget and proof of 501(c)(3) status or other tax-exempt ruling letter are required. Apply by **March 15** at *https://goo.gl/2LUXRx.*

April 16

Carton 2 Garden Contest P K12

This contest rewards preK–12 schools that creatively repurpose at least 100 milk or juice cartons for their gardens. One grand-prize winner will receive a prize valued at $5,000. Three others will receive prizes valued at $2,500 in these areas: STEM, Sustainability, and Health and Wellness. And 10 others—five from middle or high schools and five from elementary schools—will receive award packages valued at $1,000 each.

Schools don't need an existing garden to apply. Submit entries by **April 16.** Register and get free seeds and tips to start your garden at the website *https://goo.gl/yYDGXu.* ●

Summer Programs

Editor's Note

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

Maury Project Workshop for Oceanography Educators K12

This American Meteorological Society (AMS) workshop is for precollege teachers and supervisors who teach, or supervise the teaching of, units with significant oceanography content. Participants learn the physical foundations of oceanography, explore how these concepts can be employed in the classroom, and prepare workshops for teachers in their home regions to disseminate these ideas.

Participants attend a two-week training workshop at the U.S. Naval Academy (USNA) in Annapolis, Maryland, July 8–20, and learn from USNA faculty members, NOAA scientists, and other professional science educators. They receive graduate credit, a $600 stipend, lodging, meals, travel funds, tuition, and instructional materials. After the workshop, they conduct training sessions for precollege teachers in their home regions, supported by AMS.

Teachers who are interested in promoting minority participation in science are particularly encouraged to apply (deadline **March 19**). See *https://goo.gl/qm3yTk*.

Project ATMOSPHERE Workshop K12

The AMS offers this hybrid workshop for K–12 teachers who teach science courses with atmospheric content and their supervisors. The workshop introduces participants to the latest technologies for sensing, analyzing, and forecasting weather and how to incorporate them in the classroom.

Before the on-site workshop, participants complete online learning modules on atmospheric science. Then during July 15–21 at the U.S. National Weather Service (NWS) Training Center in Kansas City, Missouri, teachers participate in lectures, tutorials, hands-on lab exercises, field trips, and seminars led by NWS and NOAA personnel. Participants receive graduate credit, a $300 stipend, lodging, meals, travel funds, tuition, and instructional materials. Afterward, they are expected to conduct training sessions for precollege teachers in their home regions, supported by AMS.

Teachers and supervisors interested in promoting minority participation in science are particularly encouraged to apply (deadline **March 26**). Visit *https://goo.gl/GtnF48*.

NASA's Texas Space Grant Consortium LiftOff Institute E M H

This institute for science teachers takes place June 24–29 at NASA's Johnson Space Center in Houston. The workshop features hands-on, inquiry-based science, technology, engineering, and math (STEM) activities and opportunities to work with NASA scientists and engineers. Teachers of grades 4–12 with one year of teaching experience, a willingness to share information with others, and U.S. citizenship are eligible. The program is free for Texas teachers. Apply online by **March 30** at *https://goo.gl/aahpzm*.

DIG Field School K12

At the Discoveries in Geosciences (DIG) Field School, K–12 teachers work alongside scientists at an active geological and paleontological research site in Hell Creek, Montana. Thirty teachers will collect fossils, analyze data, construct explanations with evidence, and contribute to knowledge in the field. Teachers also get lesson plans, resources, and access to field samples for use in their classrooms, as well as increased confidence in their ability to teach Earth science and evolution.

The field school provides food, scientific equipment, lodging, and transportation after teachers arrive in Hell Creek; continuing education credits are also available. Apply by **March 31;** consult *http://digfieldschool.org*.

EinsteinPlus Summer Workshop H

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

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

EinsteinPlus will take place July 8–14 at the Perimeter Institute in Ontario, Canada. Those interested in conducting follow-up activities with teachers at home are particularly encouraged to apply (deadline **April 2**). See *https://goo.gl/zGD70q*.

Penn State Interdisciplinary Materials Research Experience for Teachers K12

This six-week program provides hands-on research experience for STEM teachers, who are paired with faculty mentors in materials chemistry, physics, and nanotechnology. From June 25 to August 3, teachers engage in demonstrations, seminars, workshops, and activities, and do research that has applications to bioengineering, chemistry, electronics, materials science, optics, optoelectronics, physics, and the life sciences. Fellows present their research at a mini-symposium afterward.

K–12 preservice and inservice teachers are eligible; participants receive a $6,000 stipend, housing, and travel expenses, though inservice teachers get $5,000. Apply by **April 15** at *https://goo.gl/Yy3iC7*.

GEEO Teacher Travel Programs K12 HE

The Global Exploration for Educators Organization (GEEO) sponsors these programs enabling teachers to study abroad and share their experiences with students when they return home. Programs are available in locations worldwide, including Argentina/Brazil, Armenia/Georgia, Balkans, Bangkok to Hanoi, Camino de Santiago, Colombia, Eastern Europe, India/Nepal, Galapagos, Greece, Iceland, Ireland, Madagascar, Morocco, Multi-Stan, Paris to Rome, Peru, Sri Lanka, Sri Lanka and Maldives, and Vietnam and Cambodia. Participants can earn graduate and professional development credit.

GEEO travel programs are open to K–12 teachers and university faculty, school administrators, and retired educators. Friends and family members may accompany participants.

Trips last for 7 to 23 days. Detailed information is available at *www.geeo.org*. Apply by **June 1.**

Climate Generation's Institute for Climate Change Education M

Join a network of teachers from across the country dedicated to bringing science, critical thinking, and problem solving about climate change into the classroom. Hear from experts and scientists on their research on climate science and climate change solutions. Engage with hands-on activities that help bring climate change concepts into your educational setting. Explore Climate Generation's Next Generation Climate curriculum, a six-lesson, interdisciplinary, middle school climate change curriculum that has students investigate the cause of the global temperature change, research the major repercussions of climate change, and find out how they can monitor and minimize those repercussions. The institute will be held at St. John's University in Collegeville, Minnesota, June 26–28. Clock hours and graduate credits are available. Refer to *https://goo.gl/XfZp1z*. ●

JOIN US

ATLANTA

MARCH 15–18 2018

Science on My Mind

NSTA NATIONAL CONFERENCE

Over **1,200** sessions

Network with more than **10,000** educators

350+ Exhibitors with cutting-edge resources

And much more!

REGISTER EARLY AND SAVE

EARLY BIRD DEADLINE
FEBRUARY 9, 2018

CONFERENCE STRANDS

- Focusing On Evidence of 3-D Learning
- Imagining Science as the Foundation for STEM
- Reflecting on Access for All Students
- Comprehending the Role of Literacy in Science

Learn more and register
www.nsta.org/atlanta

#NSTA18

NSTA National Science Teachers Association

ASK A MENTOR, **Advice Column**

Considering Relocations, Discipline, Differentiation, and Scaffolding Lessons

My partner and I are thinking of moving to rural North Dakota to teach. I teach high school science, while my partner teaches middle school. We would both like to teach in the same district. Do you have any advice on how we should proceed?

—A., Missouri

Unpacking your question, I actually see several facets I can touch upon: teaching in a rural setting; living in the country; finding jobs together.

A rural school can differ greatly from one in the city. Some rural schools are small, and teachers often teach many subjects, including ones outside their expertise. Classes may be smaller, perhaps even multi-grade. Teachers often know every student, possibly having them in class many times over several years.

However, many rural schools, particularly high schools, may be large and bus in students from many communities. Greater parent and community involvement may also happen. In northern states, many students will miss classes during snowstorms. You will have to be flexible and adapt lessons accordingly.

Don't overlook the change in lifestyle. Living in the country usually means commuting and sometimes being far away from many of the shopping, entertainment, and dining options you may be used to, although local diners can be great places to meet new neighbors. If you purchase a home, you will probably develop some good do-it-yourself skills and become a snow clearing expert. Property taxes tend to be lower in rural areas, and you will have access to farm-fresh products. I was amazed just how quickly news spread around the community, so privacy did not seem to be as great as in the city!

Finding a job with your partner in the same district can be more challenging, as an urban district usually has more opportunities than a rural one does. Contact the local teachers' association for advice on job prospects and how best to approach the district. My guess is that rural districts like having couples and families in their employment: They are more likely to settle down for the long haul and get involved in the community.

I have a few students who test me, as well as my mentor teacher, in most directions and instructions that we give and will abuse the science materials. Any suggestions on how to address this behavior?

–D., Maryland

Let me ease your mind. Everyone has encountered these students! I wish I could give you a single answer, but because this kind of behavior could be based on so many factors, you and your mentor probably have a better idea of what's driving them than I do. You might want to ask other teachers how they have handled these students. Perhaps check with the school counselors.

I employed a Three-Strike Rule to deal with student behavior. On Strike One, I would take the students aside and calmly, but directly, tell them what they were doing wrong and that it needed to stop. For Strike Two, I would pull each student out of the class individual-

ly to have a stern chat, reminding them of our previous discussions. I would even say, "Strike Two," and ask them if they knew baseball. If there was a Strike Three, offenders would be "Out!"

Here you have several options: Call home, ban them from the next lab, not allow them to choose lab partners, assign worksheets instead of hands-on labs, and so on. It is very important that you follow through on Strike Three regardless of excuses or begging. It is time to face the consequences.

I have one student whose knowledge of Earth and space science exceeds that of other students in class. I feel like I just keep giving him more work and extension activities, and I think he is getting frustrated. Do you have any suggestions for how to deal with this? How do I grade this kind of assignment?

—S., Virginia

Assigning more work to an extremely bright student is not the answer, so kudos for looking for something else! Run this by your principal for approval: Ask the student to propose a project—either long- or short-term—related to the class. The possibilities are almost limitless: videos, a lesson, models, public displays, reviews, and more. Can you find a geologist, astronomer, or other professional that could act as a mentor or be interviewed? Negotiate a grading scheme with benchmarks and expectations for the final "product" or assessment.

Options to reach a fair grade include

- Have the child complete all the work the rest of the class is handing in and use the project as extra credit.
- Replace the regular work with this project; this puts the onus on the student to follow through. Align the project with your curriculum, and create a rubric to share with the student and his family. If a mentor is involved, you should have a direct communication with him or her about expectations and share the assessment piece. Set the bar high, but make sure the student isn't penalized for pushing himself.

If the project doesn't meet all your expectations, ask yourself, "What grade would I record if any other student handed me this work?"

My middle school students are creating organism presentations. How much scaffolding should I give them?

—P., New York

Students take more interest and have greater ownership when they develop project ideas themselves and teachers provide, as you realize, a scaffold. I have found this guidance results in higher-quality presentations and a better learning experience.

First, make sure to specify what must be included in the presentations, and share your grading rubric. I would implement benchmarks with deadlines for completing research, presenting a storyboard, and other milestones. Make sure to set a time limit for the presentations.

Take the time to teach them how to use presentation software or applications. Remind them that they are the presenters, not the slides, so they should

- Limit the amount of text on any slide to just a few points in large, easy-to-read fonts.
- Not simply read the slides—face the audience and refer to notes as they elaborate on the points. Most programs allow the creation of a presenter's version.
- Use clear, large graphics that everyone can see.
- Draft scripts and rehearse presentations.

If your students make posters, consider going electronic. Have the students make the text and pictures all fit on one slide. They can save PDFs on a shared drive and maybe include peer evaluations. Electronic posters are also easier to grade than a large pile of paper!

Many rubrics are available for assessing posters and presentations that can help you with grading.

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

BLICK ON FLICKS

Downsizing: Global Thinking on a Small Scale

By Jacob Clark Blickenstaff, PhD

Matt Damon's character in his latest film, *Downsizing,* differs a bit from those of his other movies; he's neither travelling into space nor chasing bad guys across Europe. Damon plays Paul Safranek, an occupational therapist who is unhappy with his middle-class life. At a high school reunion, he reconnects with a classmate who has "downsized" and become just five inches tall.

Downsizing was invented by a Norwegian scientist about 10 years prior to the main action of the film. The minimizing procedure is promoted as a way to decrease human impact on the planet (by reducing the resources needed) and live a life of luxury (because a mansion for a tiny person is super cheap compared to a modest full-sized house). Slick marketing pitches convince people to sell all their full-size possessions and move to planned small communities that promise a life of leisure for the middle class.

Paul and his wife decide to undergo the permanent shrinking process and move into Leisureland, the premiere planned community for the small. When Paul awakens at his new size, his wife calls to tell him she changed her mind at the last minute. Now he has to figure out how to be tiny and divorced at the same time.

After an all-night party at his neighbor's apartment, Paul meets Ngoc Lan Tran (played by Hong Chau) when she comes to clean it. Tran was a political activist in Vietnam who was involuntarily downsized by her government to decrease her influence. She was the lone survivor of a botched smuggling operation, during which she hid in a TV box to escape Vietnam. Tran was injured during the attempt, which resulted in one leg being amputated just below the knee. Paul recognizes her by her unusual gait.

She introduces Paul to small poor people living just outside of Leisureland. During the rest of the film, Paul deals with learning how to enact change on a human scale through connections with other people, rather than thinking that he has to act on a global scale.

As with any good science fiction, this movie comments on our society by making the familiar unfamiliar. The perspective of someone just five inches tall is a new vantage point from which to reexamine the things we have gotten used to.

I think teachers could use *Downsizing* in the classroom in several ways. First, it could be an interesting way to open a discussion of human impact on the Earth, and the carrying capacity of an ecosystem. One stated reason for the process is to minimize human impact on the planet. Through shrinking, humans could dramatically reduce their food and energy needs, which could lessen greenhouse gas emissions and combat global warming if a large-enough fraction of the population was miniaturized. It could be a good exercise to estimate just how much less energy a five-inch-tall person would need, and how much land it would take to support people of that size.

Movies featuring dramatic shifts in scale (*Ant Man* and *Monsters vs. Aliens* are two that I have written about that come to mind) almost always ignore

some of the physics issues that should be noticed.

Not everything can be made smaller without fundamentally changing its properties: The sound of our voices is determined by resonance inside our heads. Changing the size of the resonant cavities—particularly the larynx—would change a person's voice. Shrinking the length of the larynx by a factor of 14 would increase the fundamental resonant frequency by a factor of 14, which would sound pretty weird. (That factor of 14 would take middle C on a piano up three octaves higher, for example.)

Helium only changes the resonance of a person's voice by a factor of about 3, so this effect would be much greater. Everyone who has been downsized should sound something like the chipmunks in *Alvin and the Chipmunks.* Waves can't be scaled without significant impacts.

Hearing would also be affected: The cochlea relies on resonance to change sound waves into nerve impulses, and the resonances would shift to much higher frequencies in a downsized individual. A small person probably couldn't hear low-frequency sounds made by full-size humans.

Light waves, too, are an issue. The sales pitch for Leisureland has a gag about buying an expensive diamond necklace, bracelet, and earrings. Since they're made with diamond chips fit for a person five inches tall, the total cost is just a few dollars, instead of the tens of thousands that a full-sized version would cost. That sounds great to the audience of big people.

The problem is that diamonds are pretty partly because of something called "fire," the colorful sparkling of light radiating from a cut stone. The breaking up of white light into the rainbow is called "dispersion" and is caused by the different colors (wavelengths) of light travelling at slightly different speeds in the material. For the effect to be noticeable, though, light has to travel through some appreciable amount of diamond. A tiny diamond fit for a five-inch human would not have the "fire" of a full-size diamond: It just wouldn't have enough material to break the light up very much, though it would be just as hard.

Science teachers should consider teaming up with a social studies or economics teacher to use *Downsizing*, as the film raises some potentially surprising consequences to large numbers of people being miniaturized. The economy suffers since people are not buying as much stuff, and agriculture is particularly hit by the decreased food consumption. Teachers with an interest in engineering could ask students to design items that could be used by downsized people, or by a mixed audience. For example, we see carrying boxes that have handles built in so that the tiny people aren't knocked over by jostling, and public transit options that accommodate both large and small passengers.

Finally, folks with a quantitative bent could examine the consistency (or lack thereof) in the numbers provided in the film. Initially the scaling down is described as a reduction by a factor of 2,744 (which is 14 cubed). This is consistent with a 5'10" person being shrunk to five inches tall, and the five-inch number is frequently used in the movie. On the other hand, one man is described as weighing 18 grams, which would scale back up to less than 110 pounds. The normal healthy weight for a 5'10" adult is between 132–167 pounds, according to the National Institutes of Health.

High school science teachers could integrate *Downsizing* into discussion of ecosystems, sound, optics, and ratios, and even collaborate with social science teachers to examine economic impacts of shrinking a population. ●

Downsizing *is rated R for language including sexual references, some graphic nudity, and drug use. Be sure to consult local policies on showing R-rated films in your school. Short clips or the movie trailer could be used instead of the whole film.*

Jacob Clark Blickenstaff is a senior program officer for Washington STEM in Seattle. Read more Blick at http://goo.gl/6CeBzq, *or e-mail him at* Jacob@washingtonstem.org.

The NSTA Learning Center

High quality interactive content for K–12 science teachers

Earn graduate credits and advanced degrees

Affordable and user-friendly

Moderated by world-renowned faculty

Gain knowledge specific to your area of instruction

American Museum of Natural History

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

California University of Pennsylvania

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

Montana State University – Bozeman

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

University of Nebraska

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

Unity College

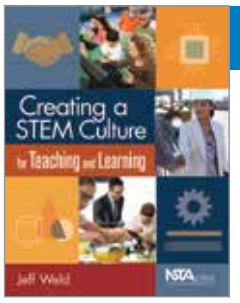
Unity College offers an online Master's in Professional Science (MS), providing the training and credentials to advance in your career path. Students choose from two concentrations: Sustainability Science and Sustainable Natural Resource Management. Teachers earn CEUs for undergraduate and graduate courses.

NSTA Virtual Conferences

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

http://learningcenter.nsta.org/onlinecourses

National Science Teachers Association



NSTA PRESS: *Creating a STEM Culture for Teaching and Learning*

Case Studies on Branding STEM Teachers and STEM Schools

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 Creating a STEM Culture for Teaching and Learning *by Jeff Weld, edited for publication here. To download the full text of this chapter, go to* https://goo.gl/V9aQWA. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Reports and studies aside, street-level practitioners wielding the science, technology, engineering, and mathematics (STEM) brand have their own interpretations and interests in quality control. STEM educators Ashley Flatebo and Deb Dunkhase offer familiar, trademarkable insights on the characteristics of STEM teachers.

STEM Teachers Define the Brand

For Flatebo, a science, technology, engineering, and mathematics (STEM) teacher at Lincoln Intermediate School in Mason City, Iowa, the identity of a STEM teacher is entirely bottled up in the opportunities he or she provides for students. Her school provides sufficient STEM opportunities to have been recognized nationally as a 2015 Outstanding STEM Middle School at the Florida Education Technology Conference, for its work integrating STEM throughout the curriculum. The school is known regionally for its after-school robotics club and Family Science Night. Lincoln is a full partner with the Iowa Governor's STEM Advisory Council's Scale-Up initiative (described in Chapter 6), bringing high-quality STEM programs like FIRST Lego League, A World in Motion, and other exemplars to their students. And Lincoln participates in the Council's Redesigned Learning partnership as well. The STEM culture there is alive and well.

Elaborating on her definition, Flatebo incorporates essential elements of STEM schools: "A STEM teacher allows students to solve problems that they can apply outside of the classroom." She firmly establishes student-centeredness: "The students are designing and creating solutions and products that they believe will be a solution to their problem." And Flatebo is an interdisciplinarian willing to distribute leadership: "The activities and projects they delve into are authentic and engaging and can connect to other curricular areas. When you walk into my classroom, you will not find me in front of a teacher-guided room; you will find students engaged in projects, working at their own pace, [and] able to verbalize the task and its importance, and you find me providing feedback and questioning students to continue their learning, as I move from student to student or group to group."

Flatebo's ability to stay at the forefront is a twist on tradition, but in line with the times. "The most valuable professional development for me is Twitter. I routinely participate in chats and follow other STEM leaders and schools within the state and country. This allows me to share what I am doing and gain ideas from others to enhance the curriculum within my classroom." And as an Instruction Coach, one of Flatebo's responsibilities is to instill a culture for STEM beyond her own classroom. She enlists a corps of ambassadors to help. "Students can drive what happens in a school. Through discussion with their peers and the excitement in their voices, a spark within the school will start." Through them, she wins over the community. "When students go home and can explain their learning to parents/guardians and are excited to share, parents/guardians begin to take interest in what is happening in the classrooms." Mutual trust incubates innovation at Lincoln. "Teachers [who] are willing to open their doors and allow other teachers in and share their ideas will allow others to see the engagement level of students." And none of what a school like Lincoln accomplishes is possible without supportive leadership. "Having administration that allows teachers to take risks and are open to new ideas helps to build a school with a growth mindset."

Deb Dunkhase is an out-of-school STEM educator, directing the Iowa Children's Museum (ICM) in Coralville, Iowa. The ICM is an award-winning mecca of exploratory discovery for youngsters and their families from across the Midwest, and a shining light of innovation on the power of play. Dunkhase and her staff of "Play-ologists" adhere to a STEM educator definition remarkably in line with Flatebo's, seeing their role as "helping students explore a problem or challenge using science and math concepts to build their understandings of the issue, followed by the use of engineering and technology in search of a solution to the problem or challenge." And that's often toddlers flexing their mental muscles. The informal learning environment is especially well suited to be active and child-centered, according to Dunkhase. "STEM education becomes powerful when content is presented in the context of a real-world situation." A welcome and recurrent theme. Dunkhase continues, "When the four disciplines of STEM are fully integrated into the student's everyday life experiences, it matters more to both the teachers and the students." Content and interactive learning experiences at the ICM are all built around content that is interdisciplinary and recognizable to the learner.

For play-ologists at the ICM, "It's all about going where the kids are and providing a basic map of discovery for them to follow with the knowledge that the students are going to take numerous twists and turns along the way," exemplifying the essential element of flexibility. By respecting and valuing those detours, "that's where the kids are going to find the self-confidence and STEM identity they're going to need in life to be successful." To bring a high-quality standard of STEM excellence to the ICM, Dunkhase and her team committed to a professional development model that equips them to design and assess programs rather than students, a key differentiator from the formal school milieu. The *Dimensions of Success STEM Program Quality Assessment Tool*, developed by the PEAR (Program in Education, Afterschool, and Resiliency) Institute at Harvard University, guides the ICM in comprehensively examining its STEM practices, from how it uses space to how students interact with exhibits and one another, as well as what content and reflections arise as outcomes (Program in Education, Afterschool, and Resiliency 2016). Dunkhase closes with a signature of the STEM brand—continuous improvement through collaboration: "Our staff are committed to high-quality STEM education, but no matter how well we serve the kids with whom we work, we welcome the opportunity to share and learn from other likeminded STEM informal educators across the state." ●

Are you interested in shaping the next generation of K–12 science educators?

Apply to be the next Field Editor of the *Journal of College Science Teaching*.

The National Science Teachers Association is looking for the next Field Editor of the *Journal of College Science Teaching* (*JCST*).

JCST is a peer-reviewed journal published by the National Science Teachers Association. Each issue includes articles, editorials, and columns that emphasize innovations in teaching and learning in the natural sciences at the college and university level. The journal is published bimonthly and reaches a wide audience of readers who are professionals in the field of science education.

The Field Editor has ultimate responsibility for the journal's content. The ideal candidate instructs in the natural sciences or in teacher preparation at the college level, is engaged in educational research, is a strong editor, and is dedicated to improving science education for all.

Responsibilities include the following:

1. Establish and support a vision for the *Journal of College Science Teaching* consistent with the emerging directions of the profession.
2. Communicate with prospective authors, reviewers, thought-leaders, NSTA members, Advisory Board, College Science Teaching Committee, and publications staff.
3. Oversee all aspects of the manuscript review process, ensuring that those submissions ultimately published reflect the highest levels of professional communication in the field.

This is a part-time, three-year appointment, renewable for additional terms. Travel is required (two trips per year to regional and national conferences). Stipend and training are provided.
To apply, e-mail a concise vita (no more than two pages) and a letter that specifies related experience and background to the Publisher, David Beacom (dbeacom@nsta.org), by **March 15, 2018**.

For answers to frequently asked questions, visit http://www.nsta.org/jcst/fieldeditorfaq.aspx

(All dates are deadlines unless otherwise specified.)

February 28—Presenter Peggy Carlisle will offer advice on creating a winning application for the **Shell Science Lab Regional Challenge** during this free NSTA Web Seminar. Teachers working in Shell "targeted asset" areas in Alabama, California, Louisiana, Pennsylvania, Texas, and South Dakota are eligible to apply for the $15,000 grant. The session will run from 6:30 to 8 p.m. Eastern Time. For more information on NSTA Web Seminars or to register, visit *https://goo.gl/N2jJDE*.

March 1—How do you teach middle school students to become reflective thinkers who can understand new information and connect it to different ideas? Share your strategies with your fellow educators by submitting your manuscript for the October 2018 issue of ***Science Scope,*** NSTA's peer-reviewed journal for middle school science teachers, by today. General-interest manuscripts, commentaries, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

March 15—The **2018 NSTA National Conference on Science Education** opens today at the Georgia World Congress Center in Atlanta, Georgia. The conference strands are Focusing on Evidence of 3-D Learning, Imagining Science as the Foundation for STEM, Reflecting on Access for All Students, and Comprehending the Role of Literacy in Science. NSTA and Georgia Science Teachers Association members who register by **February 23** pay $315. The conference runs through March 18. For more information or to register, visit *www.nsta.org/atlanta*.

April 1—Share your best strategies for applying Newton's Third Law, constructing investigations into the factors affecting electric and magnetic forces, and more related to **"Motion and Stability: Forces and Interactions"** for the November/December 2018 issue of ***Science Scope*** by today. Commentaries, general-interest manuscripts, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

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

NSTA's New Engineering E-Mail List

NSTA now has a member e-mail list focused on engineering-related topics: *engineering@nsta.org*. NSTA member David Vernot, curriculum consultant at Butler County Educational Service Center in Hamilton, Ohio, who initiated the creation of the list, says he did so because "engineering [is] explicitly included as a fourth discipline" in the *Next Generation Science Standards*, and "STEM (in my mind) is more interdisciplinary in nature, [while] engineering focuses specifically on the 'E' in STEM." He adds that the engineering list "can boost quality engineering activities in K–12 through the interactions for which the [NSTA] lists are famous!"

Vernot suggests members could post about engineering-related topics, "from elementary teachers seeking and sharing ideas, to secondary engineering lab teachers asking about supplies, to science content teachers looking to integrate engineering into their lessons." He notes that "the iterative nature of engineering through the engineering design process (EDP) can be one major focus…Engineers and engineering teachers could provide feedback to elementary teachers, including content knowledge to support their EDP challenges, [and] the list can be actively watched by folks interested in providing support to preK–12 in this field. (And the lists are famous for having folks actively watch and support the discourse online!)"

To subscribe, visit NSTA's e-mail lists page at *https://goo.gl/4ciuER*. Please share your thoughts about the list with NSTA by e-mailing *membership@nsta.org*. ●

Index of Advertisers

American Museum of Natural History, *www.amnh.org*	6	Howard Hughes Medical Institute, *www.biointeractive.org*	2
ASM Materials Education Foundation, 800-336-5152, *www.asmfoundation.org*	9	National Science Teachers Association, 800-722-8700, *www.nsta.org*	8, G4, G6, 11, 12, 14, 15, 16, 18
Carolina Biological Supply Co., 800-334-5551, *www.carolina.com*	20	University of Nebraska Online, 888-622-0332, *www.online.nebraska.edu*	7
Educational Innovations, Inc., *www.teachersource.com*	13	Vernier Software & Technology, 888-837-6437, *www.vernier.com*	5
GEICO, 800-368-2734, *www.geico.com/edu/NSTA*	G3		

National Science Teachers Association
1840 Wilson Boulevard
Arlington, Virginia 22201

NON-PROFIT ORG.
U.S. Postage Paid
CAPITOL HEIGHTS, MD
PERMIT NO. 953

3-D Printing Copies Properties of Human Tissues

Scientists are expanding the biological applications of 3-D printing, or bioprinting, by incorporating the use of cryogenics. Researchers at Imperial College London created soft structures that copy the properties of the softest human tissue using a composite hydrogel as the "ink" in a 3-D printer.

As the gel was extruded, it was cooled using dry ice in an isopropanol bath. The resulting structures were found to have a similar stiffness as heart and lung tissues. Researchers later seeded scaffolds made from the process with dermal fibroblast cells to see if they would attach. The cells attached and survived, leading researchers to conclude the structures may have potential use for a variety of applications, from tissue engineering to creating model organs for surgical training.

The study was published in *Scientific Reports* in January. Read more online in Science Daily at *https://goo.gl/3QHymx*. ●

Quotable

Mistakes are lessons inside out.

—Matshona Dhliwayo, Canadian philosopher, entrepreneur, and author