Initiatives Blend Science and Engineering

As technology rapidly changes, so do jobs—and “it is no longer possible to rely on one specific trade or skill to create a career,” says Roxanne Moore, a postdoctoral fellow in Georgia Institute of Technology’s School of Mechanical Engineering. “[E]ven top engineering schools are embracing more flexible curricula with heavier emphasis on design-build activities and capstone design projects rather than specific course content....[E]ngineering college graduates need to be grounded in [basic science and math core content] and equipped with an engineering mindset to solve the problems of the future,” Moore contends.

While demand for skilled workers in science, technology, engineering, and mathematics (STEM) is high, creating “truly integrated STEM courses at the middle and high school level that are relevant, authentic, and flexible enough to be taught to students of varying skills [is challenging],” she notes. To meet that need, the Advanced Manufacturing and Prototyping Integrated to Unlock Potential (AMP-IT-UP) initiative—with which Moore is working—is designing engineering technology courses for grades 6–9 that support Georgia’s science and math standards, Common Core State Standards, and Next Generation Science Standards (NGSS). A collaboration between Georgia Tech and its Griffin-Spaulding County School System (GSCS), AMP-IT-UP is funded by the National Science Foundation’s (NSF) Math and Science Partnership program.

“We are attempting to bring the ‘maker movement’ to middle and high school audiences,” observes Moore. The courses incorporate design-build activities into entrepreneurial and business contexts, providing relevance to foundational math skills and science practices while integrating problem solving and cutting-edge technology. They require students to draw and render design concepts, communicate design concepts to their peers, and fabricate design artifacts while engaging in the engineering design process,” she explains.

AMP-IT-UP co-principal investigator and program director Marion Usselman, an associate director for federal outreach and research of Georgia Tech’s Center for Education Integrating Science, Mathematics, and Computing (CEISMC), offers this example: “In one middle school course, students are business owners working [on] developing a carnival game that uses a pneumatic catapult. [They are asked,] ‘To make a profit, what is the catapult’s target area, and what percentage of shots make the target area?’

‘Students pitch their ideas for investing in this game...The activity makes them engage in mathematics by giving them a context. They engage in the basic science and math behind it and have to explain their choices,” says Usselman. Later, students “repurpose the catapult to be used in a medieval town that has a disease epidemic. They have to design a cart to balance on and travel down a zip line while carrying a payload of plastic bears.

The Gateway Project at the Museum of Science, Boston, introduces educators to hands-on engineering activities. They also participate in Design Challenges at the museum. Here, educators are designing a cart to balance on and travel down a zip line while carrying a payload of plastic bears.
ery Research K–12 program, SLIDER uses “robotics and engineering design within a project-based learning context to teach core physical science content” to eighth graders, Usselman relates.

For example, instead of just showing students how to build and program robots, SLIDER teachers have students “do engineering activities, but...in the context of learning about friction and balanced and unbalanced forces, using their robot to investigate this,” she says.

Both initiatives have shown “that though [science and engineering] are closely related, and can be productively used to support [each] other during instruction, there are definite limits to how much one can integrate them while still covering the specific content dictated by the state standards. For instance, within a core science course, each engineering design activity must explicitly, and fairly efficiently, lead to an increased understanding of a core science concept. Given the time constraints and girth of concepts found in a typical science classroom, our curriculum designers prioritize learning goals and use NGSS to help shape instruction and assessment in the curriculum. We develop science curricula with the mindset that engineering and design engage students and offer complementary skills and understanding to the science core ideas and practices,” she maintains.

The Gateway Project
The Museum of Science, Boston, launched the Gateway to Technology and Engineering Project through its National Center for Technological Literacy® (NCTL) in 2005 to help Massachusetts school districts develop strategic plans to implement K–12 technology and engineering programs, while introducing educators to curricula and resources—not only from the NCTL, but from a range of sources—so they can develop a strategic action plan for their district. At the program’s annual symposia, districts can continue sharing strategies and discover new ideas. “Educators have implemented STEM academies, developed STEM certificates, and conducted workshops for colleagues in their districts. We have empowered teachers to see themselves in a different light,” says Spicer.

The project has learned what teachers and districts need to integrate STEM. “Many of our teachers wanted technical assistance and support, so we now offer more [of that],” she notes. Teams also now must include an administrator who can support teachers and help create action plans, Spicer relates. School site visits were added, and Gateway holds progress sessions in the fall and spring that allow teams to explore next steps, such as adding another course and evaluating their progress.

To scale up the program, “we’ve added a regional leader boot camp to train educators from experienced Gateway districts to help conduct the institutes and provide technical support,” says Spicer. These regional leaders are “content experts” who can support and inspire teachers to develop STEM programs. They can also offer business leaders strategies to engage them in developing their STEM pipelines, which enable students to pursue STEM majors and careers, she points out.

“To move STEM forward is a collaborative effort that should involve parents, school districts, higher education, and the community in being advocates for change,” she contends.●
Assessing for NGSS

By David L. Evans, PhD, NSTA Executive Director

Since the release of the Next Generation Science Standards (NGSS), science educators nationwide have embraced the new standards. Teachers and administrators in adopting (and non-adopting) states are learning more about the changes to science, technology, engineering, and mathematics (STEM) education the NGSS would bring, and they like what they see.

The NGSS performance expectations describe what students should know and be able to do within each grade level or grade band for the purposes of assessment. A significant effort is needed to use these performance expectations to modify and guide the development of classroom/formative and high-stakes summative assessments at all levels (classroom, school, district, state, and national).

In December, the National Research Council took the first step by presenting a vision for new NGSS-based assessments. In the report Developing Assessments for the Next Generation Science Standards (http://bit.ly/1nWNlvs), an expert panel explored strategies for developing a system of assessments needed to gauge student progress, based on the vision of A Framework for K–12 Science Education and NGSS.

The report indicates students will need multiple assessment opportunities to demonstrate their competency of NGSS performance expectations. To address the three dimensions in the Framework, assessment tasks would require a number of formats. The report calls for a systems approach using a range of complementary strategies, including:

1. assessments designed to support classroom instruction (formative and summative);
2. assessments that monitor science learning on a broader scale; and
3. a series of indicators monitoring whether students receive adequate opportunities to learn science.

I am most encouraged by the prominent role of teachers in this report. It outlines a completely new assessment system and requires significant time to implement. However, it rightly identifies classroom teachers as best able to assess student learning as part of the teaching process. As such, teachers must be involved in the process of designing assessments that engage students in demonstrating their knowledge in numerous ways. The assessments also must be embedded and used during instruction to constantly determine student levels of understanding. In many respects, teachers already use formative assessment methods daily to determine student understanding, but the need is great to make these assessments indicative of the performance expectations.

Formative assessments should be systematic and systemic. To develop formative assessments that effectively support classroom instruction, we need a process that makes them more systematic and systemic. Teachers determine the formative assessments they use during instruction, but a systematic process would elevate and formalize the process and provide much-needed support for teachers to use them regularly. Teachers need access to sample assessments and assessment tools, and must collaborate with other teachers, administrators, and district leaders to create a systemic process that ensures consistency and provides a way to share data for monitoring assessments.

Technology will play a pivotal role in providing data-gathering tools. Teachers and state and district leaders require technology to support the assessment systems. Technology will enable models and samples of formative assessment to be shared, modified, and used by teachers cost-effectively on a broad scale. And students need multiple opportunities to engage in activities such as virtual labs using technology. Unfortunately, many school districts lack even the most basic forms of technology in the classroom and school.

Teacher professional development is key to success. The elevated role of teachers in developing assessments to guide instruction will require extensive, sustained, and varied opportunities for teacher professional learning. Educators need to deeply understand the vision of the Framework, how to plan effective instruction addressing the three-dimensional nature of the standards, and how to assess student learning, especially among diverse learners. Teachers also need support to develop and use informal and formative assessments to guide teaching, and to use assessments across disciplines. As a district leader noted, “The time teachers need for this professional development is critical, and we must also look for alternative methods of professional development besides face to face. Educators will need to become more comfortable with virtual learning opportunities.”

Teachers need to understand and learn how to implement formative assessments during teacher preparation. As one educator remarked, “We simply cannot reasonably expect a novice teacher to master all the elements needed to successfully implement (instruction and assessment) NGSS within a traditional undergraduate education program. A strong foundation followed by a coherent induction program (first three to five years) is clearly needed.”

NSTA is exploring ways to support teachers in developing formative assessments supporting the NGSS. We are building on the success of our formative assessment publications and short courses and are exploring tools, collaborations, and publishing efforts that will address assessments. These efforts will add to our portfolio of resources focused on the NGSS and the Framework, including interactive web seminars, peer-reviewed journal articles, NSTA Press books, online short courses, and conference workshops, all designed to build an understanding of the standards and provide a pathway for putting the best practices into action. The new NSTA position statement on the NGSS (available online at http://bit.ly/1bxxsBY) also provides recommendations to ensure successful implementation.

David L. Evans, PhD, is the executive director of the NSTA.
Using Archaeology to Integrate STEM

Educators are discovering that involving students in archaeology activities can help integrate science, technology, engineering, and math (STEM) in their classrooms. At Camarillo Heights Elementary School in Camarillo, California, for example, “we looked at how to incorporate history with what we’re doing with STEM. Archaeology is a marriage of history and science,” explains Principal Veronica Ortega-Myers.

Parent and STEM outreach professional Wendy Ropes had a connection with California State University Channel Islands (CSUCI) and helped the school find someone with archaeology expertise, Ortega-Myers reports. Coincidentally, former Camarillo Heights student Melinda Berge—now a CSUCI senior anthropology student—was working on a capstone project exploring how experiential learning can benefit elementary students and how archaeology bridges the gap between STEM implementation and Common Core State Standards in math and language arts. Berge—who says she’d like to be part of “an archaeology program with outreach to elementary students” someday—and her classmates and friends created a mock excavation project and conducted it with Camarillo Heights’ students and teachers in grades 3–5.

Typically Camarillo Heights’ third graders explore the history of the Chumash, a Native American people who inhabited California in large numbers until the late 18th century. “The fourth-grade study of history continues with the mission period [when Spanish missionaries colonized California]. This year, in addition to third and fourth graders, fifth graders participated in the dig to give them some experience with archaeology,” says Ortega-Myers.

For artifacts, Berge says she buried items “from the mission and Chumash periods based on what was known to have been used by these people.” This included terra cotta, Indian corn, small animal bones, rusted horseshoes, basketry, beads, wood pieces, porcelain, and shells. “Students [worked] in groups of six, and broke up into pairs to rotate through three jobs: excavating, screening, and notetaking,” she explains.

The dig incorporated all aspects of STEM. “Soil and weathering are a major part of California science standards, so the students explored how weathering and erosion would affect the artifacts. They looked at resource utilization: How did [the Chumash] use their natural resources?” Ortega-Myers relates.

Additionally, “students gained exposure to the technology available during the Chumash period...[Doing the dig] breaks students from the idea that technology is about digital gadgets and reinforces that technology is about the tools of a civilization. Students developed the conceptual understanding that the tools they’re using now will be future artifacts,” she notes.

“The fact that the students each had different jobs during the dig and then rotated to different jobs showed how it takes more than one job to complete a project. That is what engineers do,” she points out. When investigating artifacts, “students gained insight into how objects were engineered. How does an arrowhead become an arrowhead? What problems were ancient peoples trying to solve? It is the same type of iterative process that modern-day engineers use when finding solutions to problems,” she maintains.

Math activities included measurement, and “students were also responsible for data collection throughout the process. Students talked about how deep into the soil different objects were located. They also talked about timeline and years in relation to the artifacts,” Ortega-Myers observes.

Teachers assessed the students primarily by observing them doing the activities and collecting data, she notes. “The day of the data deconstruction, [students discussed] the items collected and postulate[d] the
various items’ purposes. Students were expected to use field-specific vocabulary when discussing their artifacts and the dig,” she adds.

“Teachers really saw the merit of exposing students to a hands-on experience that emulated the actual process of uncovering the archaeological record,” she observes. Teachers also noticed that though “[t]here was quite a bit of wind during the dig days…. students were so engaged in the activity that they did not seem overly bothered by this,” she recalls.

Berge notes that students were “exposed to archaeology as a discipline, able to distinguish it from paleontology and [the swashbuckling of the] Indiana Jones [films], and see it as a viable option for their future.”

Maritime Archaeology
Education department staff at the St. Augustine Lighthouse and Museum in St. Augustine, Florida, “try to incorporate the maritime archaeology that our four staff archaeologists do [in student programs and materials] to engage students through STEAM (science, technology, engineering, arts, and math) education,” says Katherine Ely, department coordinator of Collections, Interpretation, and Programming.

“Teaching students about maritime archaeology uses an inquiry-based learning methodology that inspires students to ask questions, think critically, and to use evidence to formulate their own hypotheses and theories. These are all skills increasingly in demand in today’s society and workforce,” she contends.

Ely says archaeology “teaches students to carefully make observations about sources such as artifacts and historic documents, then to draw educated conclusions from these observations. Our programs teach students that maritime archaeology is like being a detective who searches for clues about the past and uses [STEM] to piece together clues to an historical puzzle. In addition, the reality of undiscovered archaeological sites and the discovery of new ones show students that our knowledge base is constantly expanding.”

The facility offers three specialty programs for students about the maritime archaeology process, “based on the phases of professional scientific archaeological research and analysis” and “including techniques used to find shipwrecks, artifact conservation methods, and how sites are identified,” notes Ely. Students learn about the tools used to find shipwrecks; examine data and historic documents; make hypotheses about shipwreck locations or types of vessels and test their hypotheses; and document their own mock shipwrecks and artifacts and analyze their findings. They practice removing debris from artifacts and learn about electrolysis, the chemical reaction used to remove salts from artifacts to prevent rusting. “Children as young as third grade can understand the basics of electrolysis when they witness the process for themselves,” she maintains.

During these programs, students work in teams and use math to draw large-scale shipwreck remains or measure a cannon and anchor to determine their age. To simulate how archaeologists work underwater, students are asked to do several activities without talking.

“Our programs meet Common Core State Standards for math and language arts and other state and national curriculum standards, borrowing from the science of archaeology and the maritime history of Florida to integrate many subjects and curriculum standards at the same time,” she relates. “Maritime archaeology is a great learning tool, as it allows teachers to successfully incorporate STEM subjects with the humanities and exposes students to a greater variety of real-world applications for STEM concepts.”

—

PASCO’s NEW

Optical Dissolved Oxygen Sensor

Measuring Dissolved Oxygen has never been faster, easier or more affordable.

- No warm up time
- No calibration
- Four simultaneous measurements!

<table>
<thead>
<tr>
<th>8.86 mg/l</th>
<th>Dissolved Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 %</td>
<td>Percent saturation</td>
</tr>
<tr>
<td>21.4 °C</td>
<td>Temperature</td>
</tr>
<tr>
<td>765.1 mmHg</td>
<td>Pressure</td>
</tr>
</tbody>
</table>

Plus:
- Low Maintenance
- No Flow Dependency
- Temperature and Pressure Compensated
- Optional Salinity Compensation

It’s never been easier!

Learn more today www.pasco.com
Hands-On Lab Teaches Students About Wastewater Treatment

In 1997 in Palo Alto, California, high school science teacher Maya Slocum approached Stephanie Hughes, an engineer with the city’s Regional Water Quality Control Plant (RWQCP), seeking a way to have her students experience a case study of sewage treatment that would integrate biology, chemistry, physics, and math. Hughes—now a consulting engineer and lecturer at Santa Clara University—and her RWQCP colleagues teamed with a San Jose State University professor and graduate student and Slocum and other high school teachers to create Sewer Science, an award-winning, free hands-on lab that teaches high school students about wastewater treatment.

“We developed a recipe for wastewater using [non-toxic] household supplies, such as ammonia [to substitute for urine], toilet tissue, baking soda [instead of detergent], and coffee grounds and crushed-up pet food [to represent human waste],” says Hughes. They then developed various plastic containers to use “to model the steps of wastewater treatment. We made it into a kit, and set it up so students could test and re-test for pH, ammonia concentration, chemical oxygen demand, and turbidity,” checking water quality at each stage, she explains, adding, “It was an opportunity to do real chemical tests in the classroom and [give students] a set of data they could grasp.”

Sewer Science evolved into a week-long program for high school classes. A teacher manual and student workbook (see http://bit.ly/1eQXINm) were

I chose the right balance...will you?

If your supplier doesn’t offer a choice of brands, you might be missing out on the best value in balances for your classroom. Suppliers that offer Adam balances provide you with the best value for your classroom.

For value and reliability, ask for Adam.
If your supplier doesn’t carry Adam balances, contact us.

See our free teacher resources at
www.adamequipment.com/education

#NSTA14

See our education balances in Boston.

Booth 1643
created to accompany the kits, which were distributed to area schools at no charge. At the end of the week, teachers and students toured a wastewater treatment facility in their area.

Sewer Science “shows students something real-world that they’d normally giggle about,” Hughes remarks. Students also learn that “rather than ‘flush and forget,’ this water has to go somewhere,” she points out.

Megan Harns, contract educator for the Fairfield-Suisun Sewer District (FSSD) in Fairfield, California, which adapted Palo Alto’s Sewer Science curriculum as part of its Clean Water Outreach Program, says its version “is deliberately tailored to meet the needs of districts, teachers, and students in our area, as well as designed to use local resources and to provide accurate information about each community. The most important difference overall is that FSSD’s version of Sewer Science empowers teachers to run the lab themselves with hands-on training, step-by-step PowerPoints, lab materials, and on-call support provided by the sewer district…In addition, the elimination of paper workbooks in favor of PowerPoint–based lab instructions reduces costs for the sponsoring sewer district, as well as shrinks the environmental footprint of the whole program.”

For teachers, “Sewer Science is all action: Students are constantly making observations, taking the next step in the treatment simulation, looking in microscopes, or testing water samples while learning and practicing science content,” Harns observes. She says the FSSD benefits by “being able to fulfill its public education mandates, and through potential behavior changes made by participants (such as disposing of kitchen fat in the trash instead of down the drain, leading to fewer sewer clogs).”

“The advantages of the program for me are that the model of the wastewater treatment process is mirrored exactly after the FSSD process, so I get to bring that into the classroom,” says Jill Bolduc, environmental science teacher at Fairfield High School. “The equipment is easy to use, and all supplies for testing and safety are included, which is great during these budget-decreasing times…At Fairfield High School, the science department is already focused on adapting lessons to the Next Generation Science Standards, newly adopted by California, and we’re looking at including the Sewer Science curriculum in biology courses as well.”

**National Expansion**

Though Sewer Science originated in Palo Alto, it soon came to the attention of the Water Environment Federation (WEF), which provided funds to the Palo Alto team to build kits, ship them to its WEFTeach conferences, and train wastewater staff and teachers in the cities where the conferences are held. In 2003, the Palo Alto RWQCP team attended the WEFTeach conference in Los Angeles and introduced Sewer Science to Los Angeles Unified School District (LAUSD) teachers and county and city sanitation professionals. Los Angeles adopted the program, and the LAUSD “scaled it up to align with their population and demographics,” says Jennifer Kong, sanitation associate engineer for the City of Los Angeles Bureau of Sanitation (BOS). The city’s BOS staff also hold “seminars for college students studying urban planning,” she notes.

Los Angeles and Palo Alto sanitation professionals have collaborated to enhance the program and have attended WEFTeach conferences and trained teachers in cities across the country, she adds.

As Sewer Science’s popularity increased, the City of Los Angeles BOS developed a set of videos for teachers and students. “We wanted to have this program continue and be sustainable for future generations and have the materials used as training tools,” Kong maintains. The videos depict treatment processes, testing procedures, and careers in the wastewater treatment industry. The DVD for teachers explains how to implement and teach the program.

“So far, we have had more than 19,000 students participate in Sewer Science over the past 10 years,” says Luis Durrry, a BOS associate engineer who helps manage the program.

**Changing With the Times**

As the nation has experienced economic woes and standardized testing has become frequent in schools, Sewer Science has had to change. Teachers in the Palo Alto area “said they had to devote time to ‘teaching to the test,’ so they no longer had time for [Sewer Science],” Hughes reports.

Thomas Wyatt, a Los Angeles BOS environmental engineering associate who manages Sewer Science, says the city has had to discontinue its popular Sewer Science Technical Competition due to budget cuts affecting the number of staff available to run it. As part of this event, which began in 2004, students created models, posters, and videos of water pollution and conservation.

Los Angeles also had to stop expanding Sewer Science. Currently, “we loan out equipment and testing materials to schools that already run the program and provide them with a concentrated dose of sludge from the treatment plant to complete the wastewater treatment process, but unfortunately, we’re not starting the program in new schools at this point,” he explains.

The Washington Suburban Sanitary Commission (WSSC), which has administered Sewer Science in Maryland’s Montgomery and Prince George’s Counties for the past three years, dealt with staffing limitations by condensing the program from five days to one day, says Angela Ballard-Landers, WSSC’s community relations coordinator. Students and teachers tour a wastewater treatment plant to learn about the process from WSSC wastewater treatment operators, and “we supply everything, including the bus to transport them and food,” she relates. Participation is open to public and private schools and homeschool groups, she notes.

Last June, WSSC held a teacher training session for the first time. “We provide [each teacher] with a toolkit with enough supplies to work with a couple of classes at their school. Teachers can also train their colleagues,” she asserts. “The students will get to see in the plant what they did in the classroom setting.”

---

American Wilderness Leadership School

Jackson, Wyoming – Bridger Teton National Forest - In the Mountains

- A program that ignites enthusiasm for teaching
- Science-based Conservation and outdoor education
- College Credit and Continuing Education Units Available
- 2014 Summer Professional Development Workshops
- Tuition and Travel Stipend paid by HLF for a limited number of teachers

Contact American Wilderness Leadership School:

520-620-1220 ex. 231
www.SafariClubFoundation.org
21st-Century Skills Vital for Students, Challenging to Impart, Say Educators

Core subject knowledge; learning and innovation skills; adaptability; and non–routine problem solving—these abilities and more comprise what are commonly referred to as 21st-century skills. Most educators agree that proficiency in these areas will help equip today's students for success both now and in the future. But many have struggled with how to impart that knowledge and how to measure the effectiveness of instruction in these areas.

In a recent informal NSTA Reports poll, only 40% of educators said they always consider applicable 21st-century skills when planning lessons, while 52% reported they sometimes do. Nearly 80% said some 21st-century skills take precedence over others in the science classroom, with non–routine problem solving (50%), learning and innovation skills (43%), and complex communication/social skills (41%) cited most often (respondents could choose more than one skill). When asked to name additional crucial 21st-century skills, many educators noted cooperation, collaboration, technology, critical thinking, and adaptability. Others said students must develop “persistence, pro-activeness” and “girt (stick-to-it-ness)” along with written communication skills and a strong work ethic.

Half of respondents had participated in some form of professional development focused on 21st-century skills, with seminars, workshops, or courses being the most common form (69%). Several educators lamented the difficulty of assessing 21st-century skills, calling their own efforts “dismal, but improving” and “some good, some not so much.”

Here’s what science educators are saying about teaching and assessing 21st-century skills.

Ways to Assess

I use the “modeling physics” pedagogy in order to generate labs that are based on critical thinking and problem solving. Knowing how to accept or reject lab data reinforces information literacy. My STEM [science, technology, engineering, and math] class includes assessments and projects specifically reinforcing good information literacy vs. poor information literacy.

—Educator, Middle and High School, Virginia

By varying my assessments and increasing the depth of the assessment, so that I can [assess both] skill and content knowledge. An example being my performance assessments, which [focus] on Innovation (creating and performing a lab, which is guided to a predesigned scenario), Collaboration (always working in groups, but not necessarily in person; Google docs and video chat technologies are encouraged), and Communication (done through various mediums, including short “pitches,” writing pieces, long presentations, and more). This is all completed under the umbrella of a lifelike scenario and allows me to both focus on separate skills and . . . see how they can complement one another.

—Educator, High School, Massachusetts

I use modeling instruction, so I assess my students’ skills at problem solving daily with various new challenges.

—Educator, High School, Michigan

Experimental design, interpreting work of scientists.

—Educator, High School, Tennessee

I use rubrics to see if they can successfully communicate ideas using technology.

—Educator, High School, Nebraska

Informal assessments, observations, lab activity, formal exam.

—Educator, High School, South Carolina

Integrative, performance-based tasks.

—Educator, Middle School, Maine

Just informally, checking who finishes their homework, who turns in their homework on time, who manages their technology appropriately.

—Educator, High School, Tennessee

Presentations about how they approached and solved a problem rather than seeing if they came up with the correct answer.

—Educator, High School, Ohio

Which 21st-century skills take precedence over others in the science classroom?*

<table>
<thead>
<tr>
<th>Skill</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core subject knowledge</td>
<td>39%</td>
</tr>
<tr>
<td>Learning and innovation skills</td>
<td>43%</td>
</tr>
<tr>
<td>Information, media, and technology skills</td>
<td>28%</td>
</tr>
<tr>
<td>Life and career skills</td>
<td>11%</td>
</tr>
<tr>
<td>Adaptability</td>
<td>18%</td>
</tr>
<tr>
<td>Complex communication/social skills</td>
<td>41%</td>
</tr>
<tr>
<td>Non–routine problem solving</td>
<td>50%</td>
</tr>
<tr>
<td>Self-management/self-development</td>
<td>36%</td>
</tr>
<tr>
<td>Systems thinking</td>
<td>20%</td>
</tr>
</tbody>
</table>

*Respondents were asked to select no more than two options.

Which type of professional development activity focused on 21st-century skills have you taken part in?*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference session</td>
<td>47%</td>
</tr>
<tr>
<td>Seminar, workshop, or course</td>
<td>69%</td>
</tr>
<tr>
<td>Training presented by your school or school district</td>
<td>44%</td>
</tr>
<tr>
<td>Discussion/activity in your Professional Learning Community</td>
<td>34%</td>
</tr>
</tbody>
</table>

*Respondents could select multiple options.
Data Collection for the Wireless Generation

Meet Go Wireless™ Temp from Vernier

Vernier introduces Go Wireless Temp. This rugged, stainless-steel temperature probe is the first in a series of wireless sensors that communicates directly with your iPad®. It’s completely wireless, affordable, and backed by Vernier’s legendary support.

For complete details go to www.vernier.com/gw-temp

Quotable

Emulate those teachers that instilled the sense of wonder and curiosity that inspired you.

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

What Else Is Needed

[Students should be able to think] on their own without being told correct answers.—Educator, High School, Indiana

[The] ability to assess the quality of information they receive.—Educator, High School, Kansas

[Students] need to learn other things aside from technology. Basic academic skills—reading, writing, and arithmetic—are falling behind.—Educator, Middle School, New Jersey

I think it is important for these students to be independent, self-motivated learners.—Educator, High School, Tennessee

[Students need] the ability to collaborate and evaluate the worthiness of resources/information.—Educator, Middle and High School, Florida

Actually learning some course content, not just looking things up on the Internet.—Educator, High School, Pennsylvania

[Students need] the ability to show independent initiative for learning and carrying through on investigations, projects, assignments.—Educator, Elementary, Washington

[Students need] dexterity skills, including basic hardware/tool familiarity; communication skills, including basic concepts of coding/programming; ethical evaluation of behaviors and decisions.—Educator, Middle and High School, Virginia

entiated learning.—Educator, High School, Ohio

This is tough. Core knowledge skills can be assessed [by] traditional exams; problem-solving skill can be assessed by assigning research data that students then analyze (in class or on exams).—Educator, Institution of Higher Learning, Oregon

[1] use six tenets of professional presentation, work ethic, knowledge, resources, writing, teamwork.—Educator, High School, Nevada

Using a variety of rubrics and performance tasks that require application of science content to public policy issues.—Educator, High School, Washington, D.C.

Whiteboard meetings, unit assessments.—Educator, High School, Ohio

Written work, presentation skills, ability to use other resources than textbook.—Educator, Middle School, Massachusetts
Magic Sand

Magic Sand is regular sand which has been dyed and coated with a hydrophobic substance — a substance which repels water. The coating on the outside of the magic sand repels water and keeps the sand dry! Simply remove the sand from the water with a spoon... it is perfectly dry! Available in blue. Please indicate quantity.

MS-2BLU $5.95/lb.

Fluorescent Magic Sand

Magic Sand now available in UV glowing fluorescent colors. Use a UV light source (see page 56) to see it glowing in the dark. Available in orange, pink, and green. Please indicate color and quantity.

MS-3ORG $5.95/lb.
MS-2PNK
MS-3GRN
A new short film for the classroom from HHMI

THE ORIGIN OF SPECIES

LIZARDS

IN AN EVOLUTIONARY TREE

Watch online or order the free Origin of Species trilogy DVD at
WWW.BIOINTERACTIVE.ORG/SHORTFILMS
#1. Stay current in your field—enjoy 20% savings on more than 267 NSTA Press® books.

#2. Access to learning modules and customized lesson plans in the NSTA Learning Center.

#3. Free subscription to a journal of your choice—designed for all grade levels.

#4. Enjoy a free subscription to our monthly newspaper, NSTA Reports.

#5. Download journal articles—members have unlimited access.

#6. Network and contribute to the NSTA Blog, an easy-to-use platform.

#7. Participate in our 18 vibrant listservs—collaborate with teachers who ask questions on everything from general pedagogy to “how do I use this piece of equipment?”

#8. Enjoy up to $95 off our National and Area Conferences—an unparalleled professional development opportunity.

#9. Access to NGSS@NSTA resources—they’ll provide a pathway for incorporating the Standards into classroom instruction.

#10. Year-round, face-to-face, and online learning opportunities.

#10 REASONS TO BECOME AN NSTA MEMBER

For more information or to become a member, www.nsta.org/membership or call 1.800.722.6782
NGSS: A Professional Development Challenge
By Bill Badders, NSTA President 2013–14

The Next Generation Science Standards (NGSS) chart a path to creating opportunities for all students to develop a strong science background. But with any reform effort, it is what happens in the classroom that will ultimately make NGSS implementation a success. For that to happen, a well-planned, strategic effort will be required to provide the professional development teachers will need to use the standards to adjust their instructional practice.

Too often teachers are not provided an adequate amount of science–focused professional development (PD) at the local level. Findings from the National Survey of Science and Mathematics Education reveal that only 59% of elementary teachers have attended science–focused PD in the past three years. While 89% of middle school and high school science teachers have attended more science–focused PD, the content of those sessions, like those of the elementary teachers, rarely focused on deepening their understanding of how to teach science, even though we know teachers need an enormous amount of skill and knowledge to teach quality inquiry-based science.

Teaching science requires knowing, understanding, and applying a wide variety of practices related to pedagogical issues and the theory of teaching, management skills, inquiry and science teaching, science content and materials, and assessment. Many skills and understandings are needed in each of these areas:

**Pedagogical Issues and the Theory of Teaching**
- Understanding how children learn
- Understanding age-appropriate activities and lessons
- Understanding and preparing for the developmental nature of inquiry

**Management Skills**
- Classroom management skills
- Materials management
- Teacher facilitation skills

**Inquiry and Science Teaching**
- Facilitating student exploration
- Developing teacher questioning skills
- Extending and applying knowledge
- Planning and conducting student-developed experiments
- Connections to other science disciplines and to engineering practices

**Science Content and Materials**
- Understanding science content for each unit
- Knowing age-appropriate science terms children use in the context of exploration
- Knowledge of safety precautions

**Assessment**
- Embedded assessment
- Understanding alternate forms of assessment (alternative and authentic)
- Using formative and summative assessment
- Using assessment to conduct action research to improve practice

When we reflect upon this list, it is clear an enormous amount of work will be expected from teachers to implement the standards. It is imperative that local, state, and national leaders understand the effort to provide high quality, standards-based opportunities for students will take time and a sufficient amount of money directed to science PD.

Although this task is challenging, it is not impossible. NSTA already has taken the lead in this effort with books, journal series, web seminars, and many more resources to support you in implementing the standards. A good place to start is at www.nsta.org/ngss. Please let me know other resources you have found helpful on this journey to science excellence by e-mailing me at baddersb@roadrunner.com.

Bill Badders

---

READY FOR YOUR NEXT MOVE?

**NSTA CAREER CENTER**
**CAREER ADVANCEMENT MADE EASY**

The NSTA Career Center is the ideal place to be seen by employers who are specifically looking for science teaching professionals.

POST YOUR RESUME FOR FREE!

**FREE ONLINE JOB SEARCH**
All job-seeker functions are available at no charge.

**CONFIDENTIAL RESUME POSTING**
Make your resume available to employers, and release your contact information only when you are ready.

**JOB SEARCH AGENT**
Create a password-protected account and receive automatic email notification of new jobs that match your search criteria.

**SAVED JOBS CAPABILITY**
Save up to 100 jobs to a folder in your account so you come back to apply when you are ready.

The NSTA Career Center makes finding the perfect job easy.

http://careers.nsta.org
The 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 exclusive to your area of instruction

http://learningcenter.nsta.org/onlinecourses

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 masters 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.

Mississippi State University
Earn a Master of Science degree in geosciences via distance learning through the Teachers in Geosciences program. Curriculum includes courses in geology, meteorology, climatology, oceanography, astronomy, hydrology, and environmental geoscience.

Montana State University - Bozeman
Online graduate credit courses for K–12 science teachers through National Teachers Enhancement Network, as well as online offerings for Masters of Science in Science Education. NSTA member discount.

Penn State
Earn your Master of Education in Earth Sciences. Combine courses from multiple disciplines to enrich your practicing knowledge in the field of earth sciences while also enhancing your teaching and leadership skills—completely online.

University of Maryland
The online Master of Life Sciences degree, specially designed for science teachers, is a 30-credit interdisciplinary program offering concentrations in biology and chemistry.

University of Nebraska
Choose from more than 60 online programs for classroom educators and administrators, including master’s degrees in Biology, Entomology, Science for Educators, Science/Math Education and a graduate certificate in Insect Biology for Educators. Individual courses also available.

Wildlife Conservation Society
Online graduate courses provide K–12 educators an opportunity to examine life science through interactive simulations, videos, and presentations from WCS scientists and educators. Get the most up-to-date news from field experts and explore best practices in science education.

NSTA Online Short Courses
Join NSTA's cadre of experts in our five-week moderated courses that incorporate live web seminars, interactive simulations, and classroom-ready student activities. NSTA member discount, graduate credit, and CEU’s available.
How Science Works. This free science course from iTunes University introduces middle to high school students to scientific methods and what scientists actually do. The brainchild of Betsy Barent, a teacher at Norris (Nebraska) Middle School, in collaboration with the California Academy of Sciences and University of California’s Museum of Paleontology, the course features classroom materials, activities, and links to videos. It presents a primer on the processes of science that covers exploration and discovery, testing ideas, community feedback and peer review, and benefits and outcomes. The course is available for any iOS device at http://bit.ly/KVEoRq.

Science, Speed, and Safety: Rev Up Your Knowledge. This educators resource guide accompanies the film NASCAR: The IMAX Experience, which gives students a behind-the-scenes glimpse at the world of NASCAR racing. The guide, available at http://bit.ly/19WiGsv, offers standards-based lessons for grades 4–9, as well as extension activities, background information, and a recommended reading list. The lessons for grades 4–6 emphasize math skills, the history and development of car safety measures, and the importance of working as a team. The lessons for grades 7–9 involve physics concepts, such as calculating a vehicle’s speed, velocity, and acceleration; investigating the role of friction as a vehicle turns; and the effect of air on moving vehicles, such as drag, resistance, and flow.

Nanoscale Resources: K–College. The Nanoscale Informal Science Education (NISE) Network offers resources to explore nanotechnology concepts with students of all ages at http://bit.ly/1fr9kZW. K–12 resources include videos, articles, publications, and presentations, as well as activities and digital kits from NISE programs such as NanoDays and nanotechnology-themed summer camps. In addition, Nanozoom magazine and website (www.nanooze.org) presents nanotechnology concepts through online games, articles, a blog, Q&A interviews with scientists worldwide, and theme-based issues on topics such as Molecules, Atoms, Nanomedicine, Space, Food, Self-Assembly, and The Five Senses.

Resources for college students include NanoHub.org’s Nanotechnology 101, a series of nanotechnology lectures targeted for the undergraduate level. Topics addressed include the multidisciplinary nature of nanotechnology, nanoelectronics, nanomaterials (quantum dots, nanowires, and nanotubes), and the ways scientists are using nanotechnology in the field of synthetic biology. A second lecture series, Nanotechnology 501, presents more than 100 in-depth lectures on the topic, targeted for graduate-level and professional audiences.

“The Water Cycle” song. A free download from "Mr. Steve" Roslonek (a.k.a SteveSongs), the music teacher host for PBS Kids in the morning, entertainingly covers concepts like evaporation; condensation; precipitation; cirrus, cumulus, and stratus cloud formations; and the formation of storms when cold air meets warm air in the atmosphere. Roslonek believes students retain information better when they write a song about a topic; this Water Cycle song was created during a songwriting workshop with second graders. To download it, visit http://bit.ly/1kZwSNn, and enter the code PROMO_10832_email.

Project NEURON (Novel Education for Understanding Research On Neuroscience). Project NEURON unites scientists, teachers, and students to develop and disseminate curriculum materials that connect frontier science with national and state science education standards. The focus is to produce science curricula linking modern advances in neuroscience with middle and high school level concepts. The project materials, which have been classroom-tested and revised, are available at http://neuron.illinois.edu. Unit titles ask questions like these: Do You See What I See? What Can I Learn From Worms? What Makes Me Tick...Tick? Why Dread a Bump on the Head?

The Great Diseases. This curriculum, created collaboratively by Tufts University scientists and Boston Public School teachers, engages high school students in real-world science through learning modules based on “the great diseases.” Each module at http://sites.tufts.edu/greatdiseases—Infectious Disease, Neurologic Disorders, Metabolic Disease, and Cancer—contains five units; each unit has five, 45-minute lessons, corresponding to a week’s worth of lessons. Modules
include background information for teachers and a final project requiring students to synthesize the information they learn into a document, such as a presentation or a brochure.

**Aerospace Activities: K–12.** Educators seeking to explore aerospace concepts in the classroom will appreciate the resources from the National Museum of the U.S. Air Force. At [http://1.usa.gov/lghpNiD](http://1.usa.gov/lghpNiD), teachers can access lesson plans, resource guides, interactive programs, and presentations on aerospace topics. Lesson highlights include Kite Meteorology (elementary), in which students explore how kites are used to record weather data; The Aircraft Design Challenge (middle level), in which student teams build a “flying” vehicle given a set of materials and parameters; and Balsa Wood Airplanes (high school), in which students test the flight of model airplanes they built themselves.

**Teaching and Learning for a Sustainable Future.** This multimedia teacher education program published by UNESCO (United Nations Educational, Scientific, and Cultural Organization) can help teachers, curriculum developers, education policy makers, and authors of educational materials better understand the need for sustainable development. The program at [http://bit.ly/LA4Lgv](http://bit.ly/LA4Lgv) contains 27 modules grouped in four themes (“Curriculum Rationale,” “Sustainable Development Across the Curriculum,” “Contemporary Issues,” and “Teaching and Learning Strategies”), providing more than 100 hours of professional development on the topic.

**Teaching With Games.** Have you tried to create games for the classroom but been stymied by the amount of time and effort required? If so, the EdGames website from the University of North Carolina Wilmington ([http://bit.ly/1es9PT](http://bit.ly/1es9PT)) is for you. The site contains downloadable games, templates, and utilities that K–12 teachers can use to enhance any lesson. Click on a game type (PowerPoint, Excel, Word, etc.) to read abstracts of available games and whether they are best suited for a single student or the whole class.

**BioEd Online.** This website from Baylor College of Medicine offers a wide range of science resources for K–college educators, students, and parents. The resources at [www.biomedonline.org](http://www.biomedonline.org) include interactive courses on biology topics such as genetics/genomics, environmental health, and water. The site also offers videos, lessons, slides, news bits, and a library with supplemental materials (e.g., student magazines, storybooks) to enhance classroom instruction. The website aims to provide users with accurate, current information and materials that help them increase their science skills and knowledge.

**Planetarium.** You’ll find an interactive sky map for astronomy enthusiasts of all ages at [http://neave.com/planetarium](http://neave.com/planetarium). More than 1,500 stars—the brightest stars in the night sky (every star with a magnitude up to “+5”)—are visible on the map. To navigate, click around the sky. Point at a star or planet to reveal its name, constellation, brightness (magnitude), and distance away in light years or astronomical units. Also listed are the star or planet’s Right Ascension and Declination values. Users can adjust the time and viewing location to see the sky from any point worldwide.

**Science Kids.** A lively collection of experiments, facts, games, activities, lessons, images, quizzes, videos, and science fair project ideas resides at [www.sciencekids.co.nz](http://www.sciencekids.co.nz). Targeted for elementary and middle level students, but also useful to teachers, resources are searchable by topic and by type. Students will especially enjoy the Fun Stuff section, which features science humor and “weird science” facts (e.g., snakes can see through their eyelids) and attention-grabbing videos (e.g., a clip of what happens to marshmallows in a vacuum jar).

**“Paleomagnetics” poster.** Introduce middle and high school students to an interesting science career with this poster about paleomagnetism and the people who do it aboard the *Joides Resolution*, an ocean research vessel that drills core samples and collects measurements from beneath the ocean floor to study Earth’s development. Through photographs and illustrations, the poster describes what scientists can learn about Earth from the magnetic measures of collected rock. Download it at [http://bit.ly/1fjigmX](http://bit.ly/1fjigmX).

**Global Physics Chats.** Join your colleagues at the Global Physics Department ([http://globalphysicsdept.org](http://globalphysicsdept.org)) on Wednesday nights at 9:30 p.m. Eastern Time to chat with physics educators and talk physics and instruction. New topics are discussed each week; recent talks have addressed the benefits and challenges of the two-stage exam, in which students first complete an exam individually, then working in small groups, answer the exam questions again; and effective approaches and resources for discussing climate change with physics students. If you miss a chat, the recordings are archived.

**The STEM Sprouts Teaching Kit.** A new curriculum for students ages three to five from National Grid, Boston Children’s Museum, and WGBH Education Foundation helps preschool teachers incorporate science, technology, engineering, and math (STEM) experiences in the classroom. The curriculum at [http://bit.ly/1faPegq](http://bit.ly/1faPegq) presents guidelines for preschool learning experiences and simple, age-appropriate STEM activities such as shadow explorations (science), using a magnifying glass (technology), building structures with blocks (engineering), and using the body as a unit of measurement (math). Each activity includes questions for parents that extend learning, information about how the activity helps build brain connections, and suggested books for further learning.

**Science Literacy Q & A.** Written by professor and literacy expert Elizabeth Birr Moje as part of the Council of Chief State School Officers’ Adolescent Literacy Toolkit, this informative article ([http://bit.ly/1b6nW89](http://bit.ly/1b6nW89)) presents numerous ways of using reading and writing as a way for students to learn science facts, skills, and concepts. In addition, the toolkit contains sample lesson plans for high school teachers that show how literacy strategies can be used to learn core content in chemistry, biology, and physics.

**Scientists in the Field (SCITF) Activity Guides.** The SCITF book series, for students in grades 4–8, shows people immersed in the unpredictable and dynamic natural world, making science more accessible, relevant, and exciting to young readers. At [www.sciencemeetsadventure.com/resources](http://www.sciencemeetsadventure.com/resources), elementary and middle level teachers can access activity guides with Common Core connections that correlate with many of the titles in the series (e.g., *Gorilla Doctors*, *The Dolphins of Shark Bay, Eruption!, The Snake Scientist*). Use the guides’ discussion questions as a pre-reading activity or as part of a read-aloud to deepen students’ connection with the content.●
In Ohio, state officials are worried about what students don’t want to be when they grow up—and that’s anything science, technology, engineering, and math (STEM)-related. In response, Ohio officials have proposed a bill to get and keep STEM graduates in the state. The bill, known as HB 123, would offer income tax credits to students who earn a STEM degree in Ohio and remain there for at least five years after graduation. Students earning an associate’s degree would get a $5,000 tax credit; those with a bachelor’s degree, $20,000; and those with masters or doctoral degrees, $30,000. The credits would be paid in 10% increments over a 10-year period. Those who leave Ohio before their five-year period ends would have to repay the funds they had received.

“We hear from [Ohio] companies all the time, particularly in engineering, where people say, ‘Look, we can hire a dozen engineers, but we’re having trouble finding them,’” says Ohio Rep. Jay Hottinger (R-Newark), who co-sponsored the bill. “So a lot of times, they’re not Ohio students filling those jobs.”

According to U.S. Bureau of Labor Statistics, the nation will have one million STEM openings in 2018, but data suggests that only 16% of students currently earning bachelor’s degrees will specialize in STEM fields. Hottinger hopes the bill will pass and take effect in Ohio later this year. Read more at http://ohne.ws/1fSj0a.

Many students learn about buoyancy using small clay boats. But a new program that provides free access to some of the world’s leading 3-D design software allows students to study buoyancy by digitally designing their own paper boats and using a 3-D printer to make models.

Through the Design the Future initiative, the software company Autodesk offers free access to software used in engineering, construction, and manufacturing to secondary schools in California and Texas. “If your goal is to get kids to be thinkers, this new technology can expand their writing and thinking with visuals,” says Brian Donnelly, an eighth-grade teacher in the United School District of Davis, California. Students also use it to model products, digital sculptures, and simulations.

“We want to get these tools in the hands of students and educators, tools that they couldn’t get because of the cost,” says Peggy Snyder, Autodesk’s director of education.

Curricula, online training, and certification are available to help teachers and students use the software (see http://autode.sk/1gHqZ0f). Learn more at http://bit.ly/1fgjyv.

Teachers at Greystone Centennial Middle School in Alberta, Canada, can have up to 55 students in the classroom. But because classes are team-taught, the higher class size isn’t a burden. In fact, learning opportunities have become less restrained, says one teacher.

Lynn Lang co-teaches seventh-grade language arts and social studies with Kathy Kennedy. “By myself I’d never be able to meet the needs of all my kids,” Lang says. But with two teachers, they can divide the class into smaller groups of equivalent skill levels to better meet their needs. The seventh-grade teachers estimate that their students’ reading levels range from second to ninth grade.

“It may mean one teacher taking a small group of kids while the other teacher teaches 40 who are more independent,” explains Principal Carolyn Cameron. Read more at http://bit.ly/1evZ3J3.

Try this TOPS IDEA!

**OBJECTIVE**
To construct a pole planter that allows students to draw the daily growth of a corn and bean plant to scale. To note the differences between monocots and dicots.

**LESSON NOTES**
Make a photocopy of the activity to the right for each student or lab team.

**Step 1.** Soil should be evenly moist, not soggy. Water as needed as plants grow.

**Step 2.** Demonstrate drawing, if needed. Fix reference points at correct heights on ruled paper (top of plant, leaf tips, etc.) corresponding to lines on the planter pole. Then fill in stems and leaves.

**Step 3.** Draw plants from the same side each day, tracing unchanged portions and adding new growth. Rotate the jar relative to dominant light source to encourage vertical growth. Gently tie leaning plants to the pole with a loop of masking tape.

**Step 4.** Students can research and answer this question soon after the seeds sprout. More observations are possible later, after plants develop true leaves.

**MODEL ANSWERS**

<table>
<thead>
<tr>
<th></th>
<th>BEAN</th>
<th>CORN</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
<tr>
<td>1</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
<tr>
<td>2</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
<tr>
<td>3</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
<tr>
<td>4</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
<tr>
<td>5</td>
<td>BEAN</td>
<td>CORN</td>
</tr>
</tbody>
</table>

**EVALUATION**
Journal the growth and development of a lentil and a wheat berry. Which is a dicot? (lentil) Which is a monocot? (wheat)

**EXTENSION**
Graph your plants. Plot number of days along the x-axis, height along the y-axis. Was the growth uniform?

**MATERIALS**
- Small jar, packaged potting soil, water source.
- Ruled notebook paper, scissors, and clear tape.
- Pencil and rubber bands.
- Seeds: corn kernel and pinto bean (or other dry bean). Fresh garden seed is best. Grocery products may be irradiated for long shelf life, so test before using for this lab.

1. Firmly pack a small jar with moist potting soil. Plant a corn kernel and pinto bean 1 cm deep.
2. Rubber-band a pencil, point up tightly to the jar.
3. Trim notebook paper along top and bottom lines. Fold in half lengthwise 4 times to make a striped pole. Secure with tape.
4. Number the lines as shown on the pole and on notebook paper. Slide the pole onto the pencil, setting 0 at soil level.
5. Draw your plants daily, matching the height on the pole to lines on your paper.
6. Cotyledons are ‘seed leaves’ that sprout first. Look up monocot and dicot, and tell how your plants fit these definitions.

© 2008 by TOPS Learning Systems. Photocopies permitted if this notice appears. All rights reserved.
Submit videos by March 31; visit http://bit.ly/1jBlBOH for details.

AFCEA STEM Teachers Scholarships
In partnership with NSTA, the Armed Forces Communications and Electronics Association (AFCEA) Educational Foundation is offering 50 scholarships of $5,000 each to students currently pursuing an undergraduate or graduate degree, credential, or licensure to teach STEM at the middle or high school level. Applicants must be U.S. citizens with a minimum GPA of 3.0.

Undergraduate applications will be accepted from sophomores, juniors, or seniors majoring in secondary education or a STEM field at an accredited U.S. college or university. Graduate-level applicants must be enrolled in at least two semester-equivalent classes at an accredited U.S. college or university. Credential or licensure applicants must have a bachelor’s degree in a STEM field.

Graduates from the AFCEA STEM program are also eligible for a $1,000 STEM Teaching Tools grant each year for three years after completing the program if they continue to teach in a STEM field. Apply by April 1 at http://bit.ly/VnjEWU.

The Safeway Foundation’s Grants
The foundation provides grants to nonprofit organizations with missions aligning with its own priority areas: education, health and human services, assistance for persons with disabilities, and hunger relief. Applications are accepted from teachers in schools located near Safeway stores; visit http://local.safeway.com to determine whether your community qualifies.

Grants of between $2,500 and $10,000 are available; in Delaware, Maryland, Virginia, and Washington, D.C., amounts range from $1,000 to $5,000. Grants requested in southern California must be sponsored by a Safeway employee. Apply by April 1; see http://bit.ly/13Bbk3G.

Tellabs Foundation Grants
These grants support communities where Tellabs employees live and work. (The company’s headquarters are in Naperville, Illinois, and Tellabs has offices in Vienna, Virginia; Littleton, Colorado; Santa Clara, California; and Dallas, Texas.) Grants support local and national education initiatives, with a focus on science, technology, engineering, and math (STEM) and programs that encourage understanding and protection of the environment.

Grant amounts typically exceed $10,000. Programs should have 501(c)(3) or equivalent status. Letters of inquiry must be mailed and received by April 1. Visit http://bit.ly/UqfkEc to learn more.

Frances R. Dewing Foundation Awards
The foundation awards grants to projects focused on early childhood education. Of particular interest are programs at new or unusual educational organizations or institutes in the United States with novel educational methods for this population. Programs must serve children from age two to sixth grade.

Grants range from $1,000 to $20,000; the average grant is $5,000. Tax-exempt status is required. Submit proposals by April 1; see http://bit.ly/10T6LG0.

ACS-Hach High School Chemistry Grant
The ACS also provides grants of up to $1,500 to high school chemistry teachers who want to enhance learning in their classrooms, foster student development, and spark interest in the field. Funds can be used for lab equipment and supplies, instructional materials, professional development, field studies, and science outreach events. Apply by April 1; see http://bit.ly/13Bbk3G.

ACS Dorothy and Moses Passer Education Fund
This fund awards grants to teachers at two- and four-year colleges and universities with no advanced degree programs in the chemical sciences. Grants support continuing education activities directly related to the recipient’s teaching that take him or her off campus. Apply by April 1; consult http://bit.ly/1DkR8Lg.

Association for Women Geoscientists (AWG) Outstanding Educator Award
AWG honors experienced college or university educators who have played a significant role in educating and supporting women geoscientists. Awardees may have encouraged women to enter the field, provided opportunities for field and lab experience, or served as a positive role model. Winners are selected based on their contributions as professionals, involvement with professional societies or groups, or participation in science education programs in their
communities. Nominations are due by April 1; see http://bit.ly/1htnyVB.

**NiSource Charitable Foundation Grants**
The foundation provides funding that encourages volunteer support and benefits communities in which NiSource employees and customers work and live. Eligible are nonprofit organizations with programming in the following areas: learning and science education, environmental and energy sustainability, community vitality and development, and public safety and human services. Apply by April 1; consult http://bit.ly/1fkpjnO.

**Travelers Educational Grants**
Travelers Charitable Foundation supports initiatives that improve academic and career success for underrepresented youth. Preference goes to programs for public school students in grades 5–12 and those in transition to postsecondary education. Grants ranging from $500 to $500,000 are awarded in four areas: academic achievement, postsecondary preparation, college access and success, and career awareness and readiness.

Nonprofit organizations in Hartford, Connecticut; St. Paul, Minnesota; and other areas where Travelers has a significant business presence may apply by April 11. Visit http://travl.rs/1kIQAIs.

**Westinghouse Charitable Giving**
Westinghouse gives grants of up to $5,000 to nonprofit programs supporting STEM education, environmental sustainability, and community vitality. Within these areas, the company encourages programs that aid the disadvantaged, the young, and those with disabilities. Recipients must be located within 100 miles of Westinghouse sites in Cranberry Township, Pennsylvania; Newington, New Hampshire; or Windsor, Connecticut. Submit proposals by April 15; consult http://bit.ly/MukoVU.

**Lego Children’s Fund Grants**
Grants of $500 to $5,000 go to groups that help children (from birth to age 14) develop creativity and learning skills through constructive play. The fund is especially interested in programs encouraging creativity and technology and communication projects that advance learning. Special consideration is given to groups that support disadvantaged children, serve Connecticut and western Massachusetts, or are supported by LEGO employee volunteers. Apply by April 15; see www.legochildrensfund.org.

**McCarthey Dressman Education Foundation’s Academic Enrichment Grants**
These grants help develop in-class and extracurricular programs that improve learning and nurture the intellectual, artistic, and creative abilities of students from low-income households. Educators with unique project ideas who need additional resources may apply. Those who have regular contact with preK–12 students from low-income households, are employed by a school or nonprofit organization, and have the background experience to successfully complete the project are encouraged to apply. Grants of up to $10,000 per year are available for up to three years. Apply at http://bit.ly/1gu6gLu by April 15.

**McCarthey Dressman Scholarships**
These one-year scholarships are awarded to preservice educators in their final year of a teacher education program at New Mexico State University; the University of California, Santa Cruz; The University of Texas at Austin; or Stephen F. Austin State University in Nacogdoches, Texas. The scholarship provides $6,000 of financial support and one-on-one mentoring from an exemplary teacher. Full-time students in elementary or secondary education with good academic standing may apply at http://bit.ly/19Tcfqc by April 15.

---

**Educating Students, Supporting Teachers, Exceeding Standards**

Helping students learn by:

- integrating scientific practices with science concepts and content;
- developing collaborative and analytic skills;
- scaffolding science reading skills with Comprehension Guide Questions (CGQs).

Supporting teachers through:

- professional development workshops;
- workshop tuition credits;
- the **IPS** Teacher’s Guide and Resource Book;
- the **IPS** Assessment Package;
- videos and software.

For more information about **IPS**, scan this code

![QR Code](image1)

or visit sci-ips.com/links.htm

[Also available as an ebook!](http://bit.ly/1gu6gLu)

Science Curriculum Inc.
888-501-0957
Thoughtful Curricula
Developing Thinking Students

For **IPS** ebook information, scan this code or visit

sci-ips.com/e_ebookinfo.htm

For information about our physical science workshops at Colorado School of Mines, scan this code or visit

sci-ips.com/e_workshops.htm
**Ready for NSTA Science Education Conference in Boston!**

**General Session Speaker:**

**Mayim Bialik**

**Actress + Scientist**

**Texas Instruments Brand Ambassador**

**Teach. Lead. Grow.**

**“The Power of One Teacher”**

**Professional Development Strands**

- Science and Literacy: A Symbiotic Relationship
- Teaching Elementary Science with Confidence!
- Leading from the Classroom
- Engineering and Science: Technological Partners

**What Awaits You in Boston**

- A wide range of Science, Technology, Engineering, and Math (STEM), Next Generation Science Standards (NGSS), and Common Core sessions
- 2,000 sessions, workshops, field trips, and short courses for K–16 educators
- Content development and ready-to-use teaching techniques
- Exhibit Hall featuring new products and giveaways from more than 400 exhibitors
- NSTA Science Store with 100s of professional development books; attendees receive a 20% discount
- And much more!

**National Conference on Science Education**

**Boston**

**April 3–6, 2014**

For updates and information, visit [www.nsta.org/boston](http://www.nsta.org/boston)
USDA

What’s New
From U.S. Government Sources

U.S. Department of Agriculture (USDA)
Whobuddies Adventures Booklets
Do you want to interest students in grades 3–5 in conservation? Try the Whobuddies Adventures booklets from the USDA’s Natural Resources Conservation Service (NRCS). Whobuddies are six owl cartoon characters who care about the environment. Written and illustrated in comic-book style, the booklets—The Mystery of the Sick Stream, The Great Soil Discovery, and Top Secret Field Trip—teach students about watersheds and soil health. In addition, trading cards, videos, activity sheets, and discussion questions featuring Whobuddies help spread the message. Access them at http://1.usa.gov/1iQPfv5.

Soil Education Resources
The NRCS has compiled soil science resources for K–college educators at http://1.usa.gov/1bbGbwd. These include soil science fact sheets, career information, a glossary, lessons, videos and webinars, and links for further learning. Of particular interest are “The Twelve Orders of Soil Taxonomy” poster, which presents color photographs and definitions of 12 soil types and the regions or climates where they are found, and the State Soils web page, which describes soils with particular significance for each state. Teachers can select a grade level (K–6, 7–12, and College) to access links and lesson plans to bring soil science into the classroom.

U.S. Forest Service Map App
Forest Service maps are now available free for use on iPads in the classroom through Avenza PDF Maps on iTunes at http://bit.ly/1jRuOHiL. To find the maps, download the app, then click on the Settings icon and select the Geological Service maps and the U.S. topographic, National Geographic, and Parks, Forests, and Grasslands map choices. With these settings, the Forest Service maps and the U.S. Geological Service maps will appear for download. The app will be useful in many middle level and high school Earth science classrooms.

U.S. Department of Energy (DOE) Energy 101
The DOE’s Energy 101 Undergraduate Course Framework: Teaching the Fundamentals of Energy provides an outline for universities and community colleges to teach an interdisciplinary course on energy topics. The course content at http://1.usa.gov/J6PYiYZ is based on the energy principles and concepts essential for all citizens to know and understand to be energy literate. In addition to increasing individuals’ energy literacy, the course aims to increase pathways for students to pursue energy-related degrees and careers. The site includes an introductory webinar accompanying presentation materials to learn more about the Energy 101 framework.

U.S. Environmental Protection Agency (EPA) Wetlands Education Resources
EPA’s Wetland Education Resources web page at http://1.usa.gov/Lhfj9F provides a comprehensive collection of K–12 wetland resources from EPA and from top universities and conservation organizations. Categories include Activities, Curriculum Guides, Education Programs, Teaching Tools, Videos, and Links. Highlights from the Teaching Tools section include EPA’s animated website exploring the water cycle at work and a Water Education poster series.

National Aeronautics and Space Administration (NASA)
Space Place in a Snap
These short animations from NASA’s Space Place provide quick, narrated explanations of big science questions, accompanied by an infographic and a transcript of the animated story. The first animation featured in the “Snap” format examined the question “How did the solar system form?” Watch the clip with your elementary and middle level students at http://spaceplace.nasa.gov/solar-system-formation, then download a poster of the infographic to reinforce learning in the classroom. Stay tuned for more “Snaps” in the near future!

GPM Rain EnGAUGE Toolkit
Looking for ideas and materials to host a science, technology, engineering, and math (STEM) event at your school or organization? Celebrate NASA’s Global Precipitation Measurement (GPM) Mission with a GPM Rain EnGAUGE event. The GPM mission centers on a coordinated international satellite network that provides near real-time observations of rain and snow every three hours anywhere on the globe. Scientists will use the data to study climate change, freshwater resources, floods and droughts, and hurricane formation and tracking.

The GPM Rain EnGAUGE Toolkit at http://1.usa.gov/1cWm0Tf provides everything educators need for a successful family science event at a school or other venue, including activities, planning schedules, and a sample advertising flier. You’ll find activities for all ages, from hands-on labs such as the Erosion and Landslide Lab (grades K–8) and Make a Rain Gauge (grades 6–12) to an Edible Model of a GPM satellite (grades K–8). In addition, NASA will supply GPM stickers, handouts, and other materials for your event.

U.S. Fish and Wildlife Service (FWS) Conservation Connect for Schools
Conservation Connect, a new web-based video series at http://distance.learning.fws.gov/crn.html, connects middle level students with the great outdoors and conservation careers. Produced by the FWS National Conservation Training Center, the series explores wildlife careers and new technologies being used to study and protect wildlife. An introductory broadcast for teachers briefly describes each video episode and illustrates how the videos can supplement existing environmental education curriculum, citizen science projects, and STEM content.

U.S. Department of Education (ED)
My Child’s Academic Success: Helping Your Child Learn Science
More than a dozen activities to explore science with preK–5 students can be found at http://1.usa.gov/1nunqZY. While the activities are geared for home use, elementary teachers can also do them in the classroom. The activities were designed to show students how science works in everyday life and provide them with a safe environment in which to explore and experiment.

Selected activities include A Science Walk (preK–K), which introduces young children to the science process of observing closely, Splish, Splash (grades 2–3), in which students explore volume and measurement by pouring water into containers of different shapes and sizes and comparing findings; and Crystals (grades 4–5), in which students explore the concepts of change and variation as they grow and observe their own crystals.

Science Teachers’ Grab Bag G7
Summer Programs

Editor’s Note
Visit www.nsta.org/publications/calendar to learn about more summer professional development opportunities.

Library of Congress Teacher Science Seminar. K–12 teachers and school librarians can spend a week (July 14–18) at the Library of Congress (LOC) in Washington, D.C., and use the LOC’s repository of primary sources. This seminar will focus on using primary sources in science education. Teachers will develop lessons with library education specialists and collections experts.

Teachers will learn multiple strategies for developing and implementing lessons with primary sources. Apply at http://1.usa.gov/1ffSQ2s by March 24.

Project ATMOSPHERE: Sensing, Analyzing, and Forecasting. The American Meteorological Society (AMS) offers this free workshop to help improve teacher effectiveness in generating interest in and understanding of science, technology, and math among K–12 students. K–12 teachers and supervisors responsible for meteorology content at their schools may apply. Lectures and seminars will be presented by National Weather Service (NWS) and National Oceanic and Atmospheric Administration staff.

The workshop will be held at the NWS Training Center in Kansas City, Missouri, July 13–25. Participants receive graduate credit, a $600 stipend, lodging, food and travel funds, tuition, and instructional materials. Afterward, teachers are expected to conduct single-topic sessions for precollege teachers in their home states, supported by AMS.

Members of groups underrepresented in the sciences, or who teach significant numbers of students who are members of underrepresented groups, are particularly encouraged to apply. Apply by March 28; see http://bit.ly/1baFWyb.

ECO Classroom Program. Sponsored by Northrop Grumman Foundation and Conservation International (CI), this program provides teachers with environmental science resources and learning opportunities. Teachers will travel to CI’s Tropical Ecology Assessment and Monitoring (TEAM) site in Costa Rica during July 2014 for a two-week field experience. They will collect biodiversity and climate data and conduct research projects replicable in their schools and communities.

Middle level and high school biology, ecology, environmental science, or Earth systems science teachers may apply; 16 teachers will be selected. Apply by March 31; visit http://bit.ly/16VJTVO.

Jet Propulsion Laboratory Faculty Research Program. For 10 weeks, science, technology, engineering, and math (STEM) faculty will conduct research at the NASA Jet Propulsion Laboratory (JPL) that is of mutual interest to the faculty member and a JPL researcher. Participants submit a research report and present their findings when the program concludes. They receive a $13,500 fellowship, and those who live beyond a 50-mile radius of the JPL also receive a housing allowance.

Participants must hold a full-time appointment at an accredited university or college in the United States. Apply at http://jsfrp.jpl.nasa.gov by April 1.

EinsteinPlus Workshop. This one-week intensive workshop for Canadian and international teachers focuses on modern physics, including quantum physics, special relativity, and cosmology. Participants will learn about the latest developments in physics from expert researchers, enjoy lab tours, and interact with likeminded individuals from around the world. Sessions will 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; and measuring Planck’s constant using a simple electronic circuit.

EinsteinPlus will take place July 6–12 at the Perimeter Institute in Waterloo, Ontario, Canada. Apply by April 4; see http://bit.ly/1ffTrkS.

A Field Course in Measuring and Monitoring Biodiversity. During this field course, taking place August 5–12, participants conduct biodiversity research in the Nuevo Durango Maya community, located in the central region of the Yucatan Peninsula. They stay in traditional Mayan cabins and have access to a secondary growth forest that is home to more than 400 species of birds, jaguars, pumas, ocelots, spider monkeys, and trees. Participants will publish a field report on their findings. Apply by April 15; see http://bit.ly/1daQQUz.

2014 Modeling Workshops. The American Modeling Teachers Association will hold three-week workshops for high school physics, chemistry, biology, and physical science teachers. Participants receive course materials and work through activities practicing guided inquiry and cooperative learning. Workshops are scheduled in Alabama, Arizona, California, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Michigan, Minnesota, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, and Wisconsin.

Some sites provide stipends, tuition waivers, instructional materials, and reduced-rate housing. Program dates vary by location, but all will take place between June 9 and August 8. Learn more at http://bit.ly/1bCuQIA.

Green Your School: Save Energy, Save Money

Engage Students in Real-World STEM Learning

Project Learning Tree provides:
• Teacher professional development
• Curriculum kits aligned with education standards
• GreenSchools! investigations
• Grants for student-led action projects

www.plt.org/teachenergy

Buy It Now!
Flinn Online Chemventory™
Chemical Inventory System—GHS Compliance and More!

New from Flinn in 2014—The new Flinn Online Chemventory™ is a cloud-based laboratory chemical inventory system that allows multiple users access to the database from multiple locations and devices! We’ve included OSHA/GHS information too, so maintaining an accurate chemical inventory with GHS-compliant SDS and labels is easy and convenient.

Flinn Online Chemventory™ features:

Secure Cloud-Based Access
Flinn’s Online Chemventory™ is a secure, cloud-based service that can be accessed by any computer or tablet with an Internet connection, allowing you convenient access to your Chemventory™ database from your chemical storeroom, classroom, or even your home.

Multiple User Convenience
Do you share a storeroom with other teachers in your department? No problem! With Flinn Online Chemventory™ you can set up one database and invite other teachers, lab managers, and/or administrators to view or update your Chemventory™ database for no additional charge.

Flexibility to Customize Your Database
Flinn Online Chemventory™ gives you the flexibility to identify each chemical in your inventory by the school name, chemical storeroom location, and shelf/cabinet location. You can then sort your list by each of these categories.

Link Databases Across Your District
If your school has multiple chemical storeroom locations, or your district has multiple school locations, it will be more manageable to use more than one Chemventory™ database. Flinn has made it easy to set up multiple databases and link access to users.

GHS-Compliant Safety Data Sheets and Hazard Information
You will have access to all of the updated Flinn Scientific Safety Data Sheets (SDS) through the Online Chemventory™ program and via the Flinn website. We have included Globally Harmonized System (GHS) pictograms and hazard information with every Flinn chemical in our Online Chemventory™ program.

Print GHS-Compliant Chemical Labels
GHS pictograms and hazard statements can also be printed on chemical labels through the Online Chemventory™ program.

Flinn Online Chemventory™ enables you to:

- Print, Email, and Export Your Inventory List
- Import Data from Previous Chemventory™ Versions
- Print GHS-Compliant Chemical Labels
- Create a Purchase List
- Easily Add All Your Flinn Chemicals

For more information go to flinnsci.com

5-Year License only $189.95
Track your entire chemical inventory for less than $4 a month! For $189.95 you get 5 years of access to build, view, and update your chemical inventory database. You may order the program online using Flinn Catalog No. SE3000 and we will e-mail your unique Registration Key Code. You may also order SE3000 by mail, fax, or phone and we will contact you with your unique registration code.

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Description</th>
<th>Price/Database License</th>
<th>Price/Database License 5 or More</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE3000*</td>
<td>Flinn Online Chemventory™ Program</td>
<td>$189.95</td>
<td>$159.95</td>
</tr>
</tbody>
</table>

*A minimum of one 5-year license must be purchased per participating school.

© 2014 Flinn Scientific, Inc. All Rights Reserved.
I feel overwhelmed by the grading process. It seems like I spend most of my waking hours grading homework, lab reports, tests, quizzes, notebooks, and projects. I teach two science courses at the high school level and see 150 students every day. What can I do to use my time better and meet the deadlines?

—Stacy, Seattle, Washington

One of my big “aha” moments when teaching 150 students was a realization that different types of assignments required different levels of my attention. It’s important to identify activities and assessments that demonstrate students’ understanding of a concept or their ability to use a process. These require time for in-depth evaluation.

But teachers can overwhelm themselves when trying to evaluate and designate points to every piece of student work. The real value of in-class assignments, homework, and formative assessments is in how they contribute to student learning, rather than how many points they’re worth. I know teachers who select student work randomly to get a sense of what students understand. (They explained this strategy to the students in advance.) Some teachers note whether assignments have been completed before discussing them in class. They recorded which students completed the task, then students had the opportunity to update or revise their work.

Explain to students you need time to examine their efforts on projects and written work carefully and respond thoughtfully. For example, you could divide tests into two parts: an objective part and an essay part. The former could be returned and discussed quickly (even the next day), but the essays could take longer to read and comment on. I assigned a score for each, showing students the essay part was just as (if not more) important as the objective questions.

For lab reports, borrow the idea of “Focus Correction Areas” (http://bit.ly/1fEwuYN) from our language arts colleagues. Instead of trying to review the entire report, focus on one or two key areas, such as the research question/hypothesis, data tables, graphs, illustrations, or conclusions. Glance through the rest of the report for any glaring errors or omissions if you like, but concentrate your comments on these areas.

Differentiate between proofreading and providing feedback. Part of your rubric for major assignments could be “clarity of communication,” but correcting every spelling or usage error on every assignment takes away time you could spend providing constructive comments related to the science goals (and could discourage students from writing).

Feedback should focus on what specifically the student did well, indicate where the student may have erred or demonstrated incomplete thinking, or discuss how the student could improve. With 150 students, it would indeed be overwhelming to write a detailed analysis for each student. Rubrics can be used to provide feedback, showing students how they performed on components of the task, giving you time for more personalized comments.

Use science notebooks as much as possible. Each week, review a few from each class or focus on a key assignment. Have students include their vocabulary, notes, graphic organizers, summaries, or bell-ringers and review them holistically instead of individually. During lab or small-group activities, spend some time with each group to observe their work and do a quick scan of their notebooks.

With two different subjects, you have some options to help yourself. Don’t give tests in both subjects on the same day. Give yourself some breathing room when doing labs, too. Assign projects in your two subjects at different times.

And take a break from the paperwork once in a while to clear your head: Exercise, read a novel, do some yard work, visit a coffee shop, or do something fun with your family or...
friends. Your health and sanity are just as important as today’s science quiz.

My colleague and I are early-career science teachers at a middle school. Rather than our reinventing the wheel, do you have any suggestions for how to make lab days run more smoothly, especially at the beginning and end of the class?

—Sean, Oakland, California

To ensure lab periods run smoothly (and safely), planning and preparation are essential. Every activity should relate to your learning goals and be appropriate for your students’ experience level.

Review the activities or investigations thoroughly to determine if you have the proper facilities, time, and materials to conduct them safely. Put yourself in the role of a student. What could possibly go wrong? How much guidance and support will students need? Never have you not tried or are unfamiliar with.

Plan activities for the amount of time available. If you have a single period, choose investigations that can be completed (including the introduction and cleanup) within that time or that can be paused and continued later.

Assemble materials and equipment in advance. Have extra supplies on hand, so you don’t have to leave the room to get something. Assemble trays or boxes with materials for each group (I numbered the boxes to match each team). An “inventory” card in the box or a note on the board helps students know what should be in the box. Assign a student on each team the role of equipment manager who will get the materials and alert the teacher if anything is missing.

Prepare students for the activity by reviewing the purpose, procedures, and safety issues. If students designed the procedure, check their ideas by having them show you their proposal before they start.

Monitor your students as they work. In addition to looking for safety issues or off-task behaviors, use this as an opportunity for formative assessment. You can ask or answer questions, guide their thinking, and eavesdrop on their conversations as they work. You can have a list of lab skills and record which students demonstrate them. Also note anything you want to change for the next class or the next time you do this activity.

Even your best class can run into difficulties. Never leave the room or be distracted with e-mails or phone calls while students are doing an activity. Accidents can and do happen, but you don’t want students to hide broken glass or clean up a spill with a sleeve. Deal with the situation immediately in a matter-of-fact style.

If a student is engaging in potentially dangerous behavior and does not follow your guidelines, remove him/her from the situation immediately, stopping the entire class if necessary.

Time flies during an activity, and if the bell rings while students are still working, they’ll want to rush on to their next class. Students must assume responsibility for cleaning up at the end of the period so everything is in place for the next class. Set an alarm or timer so they’ll have enough time to clean the workstations and debrief on the activity.

Post a sign at each lab station with a list of cleanup tasks. The equipment manager on each team should ensure group members complete tasks such as returning the materials to the boxes, wiping the tabletop, cleaning the glassware, turning off or resetting probes and other instruments, discarding any trash in the proper receptacle, and following other directions you may have (such as sterilizing and storing eyewear).

Boxes should be returned to a designated place where you can see the contents. Pay attention to forceps, calculators, scissors, and other items that may “disappear.” Note if anything is broken. Establish a routine in which students wait until you are satisfied things are in order for the next class before they leave. (This should be the routine on non-lab days, too!)

At the end of the day, return materials and equipment to their proper places if the activity is completed. If you’re continuing the activity, put the boxes in a secure place. Annotate your lesson plan with any concerns or ideas for next time. Update the inventory with how much of a material was used or if anything was broken or discarded.

This was an area in which I struggled at first. But with organizational strategies and routines, I found lab days were enjoyable and challenging for both the students and the teacher!

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

National Earth Science Teachers Association

Events at 2014 Boston NSTA Conference

All NESTA sessions are in the Boston Convention & Exhibition Center 052A/B unless otherwise indicated

Friday, April 4

9:30 – 10:30 am NESTA Geology Share-a-Thon
11:00 am – noon NESTA Weather, Climate, and Ocean Share-a-Thon
12:30 – 1:30 pm NESTA Earth System Science Share-a-Thon
2:00 – 3:00 pm It’s Elementary! Effective Approaches for Addressing the Earth Science NGSS in the Elementary Classroom
2:00 – 3:00 pm American Geophysical Union Lecture, “Geosciences – The Nexus of Data Driven Science and Applications”, Prof. Suchi Gopal, Boston University (CC 210A/B)
3:30 – 4:30 pm Effective Approaches for Addressing the Earth Science NGSS in the Classroom
6:30 – 8:00 pm Friends of Earth Science Reception (Seaport Hotel, Lighthouse 1)

Saturday, April 5

8:00 – 9:00 am NESTA Space Science Share-a-Thon
9:30 – 10:30 am Effective Strategies for Sharing Climate Change Science and Energy Consumption Implications in the Classroom
11:00 – noon High-Impact Classroom Earth Science in a STEM World
12:30 – 1:30 pm NESTA Advances in Earth and Space Science Lunchtime Lecture, Dr. Tamara Ledley, TERC
2:00 – 3:00 pm Using Natural Hazards as a Hook in the Earth and Space Science Classroom
3:30 – 4:30 pm NESTA Rock and Mineral Raffle
5:00 – 6:00 pm NESTA Annual Membership Meeting
Models and Approaches to STEM Professional Development
Grades K–12
This ambitious book is the perfect source of inspiration to help you kick-start your professional development program this school year. The book’s core highlights critical aspects of several successful programs and provides forward-looking insights into the needed professional development surrounding the NGSS.

The book’s emphasis is on developing highly effective teachers who are expected to improve student achievement in STEM education. *Models and Approaches* is a vital resource for state, district, and school leaders as well as classroom teachers.

Member Price: $27.96 | Nonmember Price: $34.95

Translating the NGSS for Classroom Instruction
Grades K–12
With the release of the *Next Generation Science Standards* (NGSS), you need a resource to help you answer pressing questions about how the standards fit with your curriculum, instruction, and assessments. Author Rodger W. Bybee provides essential guidance for everyone from teachers to school administrators to district and state science coordinators.

As practical as it is timely, this book includes an introduction to the NGSS; examples of the standards translated to classroom instruction in elementary, middle, and high school; and assistance in adapting current units of instruction to align with the standards.

Member Price: $26.36 | Nonmember Price: $32.95

The New Science Teacher’s Handbook
What You Didn’t Learn From Student Teaching
Grades K–12
By reading *The New Science Teacher’s Handbook*, you will learn 12 specific steps that will help you on your way to becoming a skilled classroom teacher. Chapters include lessons learned by the authors, solutions you can choose from to fit your concerns and school environment, and resources on how to create a successful classroom. “Whether you are on your way to becoming a science teacher or a teacher in your early years,” the authors write, “we feel confident the ideas presented here will help you become the teacher you’ve always wanted to be.”

Member Price: $25.56 | Nonmember Price: $31.95

Even More Picture-Perfect Science Lessons
Using Children’s Books to Guide Inquiry, K–5
With the debut of the first *Picture-Perfect Science* book more than 10 years ago, authors Emily Morgan and Karen Ansberry demonstrated their expertise at helping teachers engage children in reading and science through picture books. Their new book includes 15 all-new teacher-friendly lessons that deliver strong standards-based science content with connections to both *A Framework for K–12 Science Education* and the *Common Core State Standards, English Language Arts*, and a kid-magnet formula that will get your students engrossed in science while they improve their reading skills.

Member Price: $30.36 | Nonmember Price: $37.95

To place an order or download a free chapter, visit
www.nsta.org/store
Connecting With Professional Development Resources

By Judy McKee

Most retired NSTA folks remember the pre-internet days when searching for science lesson ideas, refreshing content knowledge, or researching for science coursework was a major undertaking, requiring hours at an institutional or college library.

Libraries housed books, journals, magazines, and newspapers, but what we needed wasn’t easy to retrieve. Back in what we joke about as the Stone Age, we would go to a campus library and find our way to the “stacks” where the Reader’s Guide to Periodical Literature—thick volumes we used to locate articles on our topic—resided. For a journal piece, the article’s title, the periodical’s title, and the date would be listed. Then we searched for the journal in huge volumes shelved chronologically. Sometimes the journal couldn’t be found there. When we successfully located information on our subject, we labored over handwritten notes and references. Years later, primitive copiers became available, but they couldn’t accommodate the awkwardly-bound journals.

We would search the card catalog’s index cards and hope the book we wanted wasn’t already checked out. If it was, we could ask the librarian for that person’s name in the hope of sharing it.

Although microfilm had been used since the 1920s, it wasn’t until the 1950s and 1960s that it was used to preserve material for information gathering. By the 1970s, libraries were employing microforms as an alternative to housing bulky copies of journals and newspaper searches could be performed on clumsy precursors of today’s state-of-the-art computers. Again, we hoped the microfilm would be available at the library. NSTA retired member Ann Rubinoff remembers, “While microfilm was interesting—in a strange, techie way—it was immensely time-consuming, black-and-white, and often beset with fuzz from the dust on the film rolls.”

Retired teacher Lynn Hyndman summarizes the research process: “It was like archaeology—tedious work combing through the relatively thin layers of library collections to unearth something of relevance hours later.”

To meet the needs of science teachers nationwide, NSTA was founded in 1944 via a merger of the American Council of Science Teachers and the American Science Teachers Association. Award-winning, peer-reviewed NSTA journals have been helpful since the 1950s. Though The Science Teacher had been published since the 1930s, it was purchased by NSTA in 1950. NSTA launched Science and Children (S&C) in 1957. The Journal of College Science Teaching was introduced in 1971. Science Scope started as an insert called The Middle/Jr. High Science Bulletin in S&C and The Science Teacher in the mid-70s; it was renamed Science Scope when it became a stand-alone journal in 1983. These journals made finding dependable information and lessons much easier.

Rubinoff recalls the ease of using the journals. “When I was a student, I actually copied whole articles from Science and Children and Science Scope, to put in big binders by topic. You wouldn’t want to know my copier bill!” Despite the expense, “what we found was important, with many ideas that formed the base of what is now, finally, considered best practice,” she adds. “In fact, it’s hard to find anything even now except computer-based activities that are not foreshadowed by the dusty tomes we dug through, hoping to find educational gold. We often did.”

Moving Research Online

Today we can’t imagine working without our computers and the internet. Realizing the need for a reliable, teacher-friendly website containing nearly anything teachers might require, NSTA launched The NSTA Learning Center in 2008. Flavio Mendez, senior director of the Learning Center, explains, “It is a professional learning community of [more than] 140,000 science educators who spend time on the portal building their library of resources, assembling and sharing collections, writing reviews, posting comments on community forums, completing professional learning plans, diagnosing content knowledge, attending web seminars, and working on self-directed science modules to enhance their pedagogical content knowledge.” When she first visited the website, Hyndman said, “I was astounded. All this collected wisdom in one place. It is a virtual university of science education!”

Mendez says users don’t need to be NSTA members or even active teachers to create a free account and use the portal. Science educators—whether preservice, currently teaching, or retired—can contribute to the thriving online community or use the content and seminars to enhance their teaching.

Tara Cantello, an eighth-grade science teacher, says, “The NSTA Learning Center is an invaluable resource. I am always searching for new ideas. I have found numerous activities and labs that are engaging for students and allow them to better understand concepts. The web seminars are informative, and the presenters are helpful. The professional articles have given me ideas for delivering content in a new way. I have gained a wealth of information from the NSTA Learning Center, and I have only scratched the surface of what it has to offer.”

As a new teacher of chemistry and physics, Rebecca Falin was introduced to the Learning Center last year as an NSTA New Science Teacher Academy fellow. She observes, “This year, I decided to have my chemistry students keep science notebooks, so I looked to the Learning Center for information on how to implement them, what to include in them, and how to encourage students to take ownership of them. I found several threads in the community forums that gave me ideas on how to implement them and assess them, what worked and what didn’t, and what kinds of assignments fellow teachers made in the notebooks. Searching the Learning Resources, I also found some journal articles and a book chapter on using science notebooks as an assessment tool. I am sure that these resources made my implementation of science notebooks much smoother and more productive.”

Patty McGinnis, currently a school supervisor and middle school teacher of gifted students, has served as an online advisor to the Learning Center since 2011. When she talks about it at the center’s booth at NSTA conferences, she says she gets “a real charge out of seeing people’s faces light up when they discover for themselves how the NSTA Learning Center is the go-to place for lesson plan ideas, increasing content knowledge, and collaborating with other professionals.”

Alyce Dalzell, a retired K–12 educator, also belongs to the dedicated group of NSTA members who assist educators worldwide through The Learning Center. Of the portal, she says, “I often picture [it] as a maze of bustling hallways filled with learners who in that moment may be searching for affirmation, knowledge, or collegiality. When you surround yourself with learners [who] share similar goals, a support system develops.”

For 70 years, NSTA has been committed to promoting excellence and innovation in science teaching through its conferences, journals, and publications. Now through the Learning Center, science educators can easily keep informed of new developments in the field and be inspired and encouraged to provide quality experiences that bring science to life for their students.

Judy McKee is a past chair of the NSTA Retired Members Advisory Board and currently serves on the board of directors for the Council for Elementary Science International. She has spent her own “retirement” running a consulting business, teaching methods courses for graduate school, mentoring new teachers, and writing.
By the time you read this column, the Olympic Winter games will be over—the medals awarded and the crowds dispersed. However, as I write, the opening ceremony has not begun, so I look forward to enjoying the drama of surprise victories and the vicarious angst of hard-fought competition.

How can science teachers use Winter Olympic events to generate excitement in class? While I am sure this can be done in countless ways, and other writers have addressed some already, I’ll emphasize three in this column: energy transformation, aerodynamic lift, and sports physiology.

Many marquee events in the Winter Olympics involve one or more persons starting at the top of an icy or snowy hill who then do everything they can to get to the bottom of the hill as fast as possible. Bobsled, luge, and skeleton all happen on an ice-lined track. In the wide range of skiing events, the number and spacing of “gates” athletes must navigate and the skill set needed to succeed vary. A number of the newer ski and snowboard events focus on the execution of tricks in a half-pipe or after launching from a nearly vertical ramp. To a physicist, these events look fairly similar: They all involve an object (the athlete or athletes) trading some initial gravitational potential energy (PE) for kinetic energy (KE) when sliding down the hill, and then dissipating KE at the bottom of the hill when coming to a stop.

An object’s KE depends on its mass and the square of its speed. Since skiers and sleds don’t generally change in mass on their way downhill, their speed determines their KE. Since greater speed means more KE, most of the skiers and sliders want to minimize the forces that could decrease their speed. Friction between their skis or runners and the ice is one major factor, and pushing the air out of the way is another. After building KE on the way down the mountain, it has to be dissipated over enough time and distance that stopping doesn’t cause injury. At the bottom of bobsled and luge runs, the ice is rough and snow-covered, and the drivers can apply brakes. At the end of a ski run, you see skiers turn sideways and skid to a stop. In the end, all the PE the skier had at the top of the hill has been dissipated by friction and wind resistance when she slides to a stop at the bottom.

The 2014 Winter Olympics in Sochi are the first time that women competed in ski jumping at the Olympics. (Men’s ski jumping has been contested since the first Winter Olympics in 1924.) Ski jumping is another of the PE to KE energy transfer events I described earlier, but with one very interesting difference. To maximize the distance the jumper travels, she needs to stay aloft as long as possible, which means she must generate aerodynamic lift while flying through the air. In most of the sports I mentioned previously, winning involves going faster, but in ski jumping, winning can require going slower, if it keeps you in the air longer.
Ski jumpers’ suits are designed to catch the air, unlike the skintight suits worn by downhill skiers, bobsled riders, and luge drivers. When the ski jumper launches from the ramp, she holds her arms at her sides, and the suit is large enough to fill up much of the gap between her arms and her torso, which increases the wind resistance on the jumper. Ski jumpers also tend to be light, so the force of the air on them is relatively large compared to their weight. Prior to the mid-1980s, ski jumpers held their skis parallel to each other while aloft, which makes intuitive sense: that way, you have two flat boards close together to almost make a single piece. But there is a better way: A Swedish jumper, Jan Bokov, popularized the now ubiquitous v-technique, which adds about 10% to the jumper’s distance by increasing the aerodynamic lift (or upward force).

A number of events in the Winter Olympics require a combination of two very different, and perhaps even opposing, characteristics: tremendous physical strength and very fine motor control. I think figure skating and the biathlon represent this best. Figure skaters must be able to execute jumps and spins that require strong legs and substantial core strength, but also must be able to place fingers and toes precisely to execute the required turns and spins. The biathlon may be an even more extreme example: Athletes must ski as fast as possible on cross-country skis, then stop and shoot small targets 50 meters away, either while standing up or lying down. To succeed at the target-shooting component, the athlete needs to pull the trigger between heartbeats, and that means he must slow his heart rate as soon as he stops skiing. It is difficult to imagine the level of control over one’s body required to be a world-class competitor in either of these events.

I hope teachers will take advantage of all the science in winter sports on display in the 2014 Winter Games in Sochi.


**We live in the 21st century. Why capture data with equipment from the 20th?**

**Basic Datalogger**
Looking for an affordable high-performance datalogger for teaching middle school through university? We feature direct inputs, so you can take measurements without adding sensors. Operates on 6MHz on 1 input
- No separate power supply: connects directly to your computer by USB!
- Wave generator: Generate waves from the analog output, just like a regular lab device
- Four sensor plugs: Datalogger recognizes the type of sensor you attach, allowing for direct measurement
- Sturdy polycarbonate housing - strong and durable
- Plug and play design - sensors snap into place
- 4 sensor inputs on DB9 connectors. Power source: +5V (50mA). Computer plug-in: Bus USB
- Includes: USB type A/B cable; user manual; CD with drivers and code; calibration

**Deluxe Datalogger**
Introducing the most powerful datalogger in the educational market! Takes data faster and more accurately than other dataloggers!
- Outstanding accuracy: Sample rate of 4 x 10MHz
- User friendly: Compact and easy to use.
- Generate waves from 2 analog outputs
- 5 sensor plugs: 4 on DB15 connectors, one analog
- Connect banana plugs directly
- 4 differential/ 8 simple analog inputs
- 2 analog outputs for wave generation
- Direct frequency measurement input
- 4 power supplies. Sturdy polycarbonate housing.
- Compatible with Labview® and Latis-Pro software
- Complete line of sensors
- Includes: power supply; USB type A/B cable; manual; CD with drivers and code; calibration

Software automatically detects which sensor you are using. Display data from all sensors simultaneously!

**Quotable**
Nothing in life is to be feared. It is only to be understood. Now is the time to understand more, so that we may fear less.
—Marie Curie, Polish-French physicist, chemist (1867–1934)
To order or learn more, visit www.nsta.org/store

NSTA is your complete source for credible and timely publications on Next Generation Science Standards. Check out our must-have resources from NSTA Press.
Do you need to refresh your content knowledge, explore a new subject area, navigate new ways to integrate science and literacy, investigate the Next Generation Science Standards (NGSS), or all of the above? NSTA’s National Conference on Science Education in Boston, April 3–6, offers opportunities for science educators in every phase of their career.

“The conference in Boston is an opportunity to learn new things—about the NGSS, about making connections with literacy, and so much more—in a very short amount of time,” NSTA President Bill Badders exclaims. “The conference focuses on important issues in science, technology, engineering, and mathematics (STEM) education, and so much more—network with colleagues.”

The conference’s featured speaker sessions will feature keynote speaker Mayim Bialik, who will discuss “The Power of One Teacher” to change students’ self-perception and their ability to succeed in science. Attendees can also contemplate “Who Are You Calling an ALIEN?” during the Mary C. McCurdy Lecture by David Aguilar and “Teaching With the Brain in Mind” by John Penick during the Robert H. Carleton Lecture.

Four featured speakers will also address the strands woven through the conference to help attendees seeking to focus their professional development efforts. “The strands—Science and Literacy: A Symbiotic Relationship; Teaching Elementary Science With Confidence!; Engineering and Science: Technological Partners; and Leading From the Classroom—will help guide those who want to concentrate their professional development on one of these areas,” Badders says.

Wendy Saul will address science and literacy during her presentation, Reading and Writing Science: What Should Be My Line?; strand sessions will address English language learners, specific writing techniques, reading non-fiction texts, and more. Yvonne Spicer will discuss Engineering and Science: Strengthening the Partnership, while the Engineering and Science strand will include project-based learning, web-based strategies, and bioengineering.

The Teaching Elementary Science With Confidence! strand includes sessions on topics ranging from differentiating instruction to curricular ideas including compost and worms. Steve Rich will encourage elementary educators to test their wings during his presentation, Chrysalis: Transforming Your Teaching. The Leading From the Classroom strand will help educators develop the skills to be both a teacher and a leader. During his featured presentation, Arthur Eisenkraft will explore the National Research Council’s Framework and the NGSS: An Opportunity for Teacher Growth and Leadership.

The NGSS will also be the focus of a featured presentation by Stephen Pruitt, senior vice president for content, research, and development at Achieve, Inc., and Rodger W. Bybee, executive director emeritus of Biological Sciences Curriculum Study. NSTA also will offer a “deep dive” on the NGSS on April 5 during the NGSS@NSTA Forum. Five back-to-back sessions will explore the NGSS in-depth, from adjusting classroom instruction to finding resources to assessing student learning. The forum will culminate in a panel discussion featuring science educators and experts in assessment that will include a question-and-answer session with the audience.

NSTA also will premiere NSTA TV, a new conference television channel covering the news and events at the conference. Produced by WebsEdge, NSTA TV will feature a new episode daily with interviews from prominent science educators and session presenters and viewers from attendees. Watch NSTA TV in locations around the Boston Convention & Exhibition Center, on selected hotel channels, as well as online on YouTube, on the conference website, on social media, and at www.websedge.com/videos/education.

Attendees can also use the NSTA conference app (www.nsta.org/conference app) to create personal schedules, access maps, take notes, share their experiences on social media, play a scavenger hunt photo game, and find answers to frequently asked questions about the conference. The app is available for iPhone, iPad, and Android devices.

Visit www.nsta.org/boston for more information on the conference, to browse sessions, and to register.

Institutes Set Stage for In-Depth Study

In case four days of intensive professional development aren’t enough, NSTA will hold eight professional development institutes (PDIs) on April 2, the day before the 2014 National Conference on Science Education opens in Boston.

The PDIs explore many facets of the Next Generation Science Standards (NGSS), from the practices to integration with literacy strategies to incorporating engineering and technology. Five PDIs include the ticketed workshop on April 2 and a “pathway” of individual sessions that will extend the targeted learning experience. The three one-day sessions will introduce educators to the NGSS and provide insight into designing NGSS-aligned lessons and developing assessments of NGSS performance expectations.

- **PDI 1—NGSS Practices of Science: Student Reasoning at the Core of Science Instruction**
- **PDI 2—Increasing Language Skills and Access to Rigorous Science Education:** Examing the Opportunities That the NGSS Provide to English Learners
- **PDI 3—Building STEM Capacity With NGSS: Addressing Engineering and Technology in the Next Generation Science Standards**
- **PDI 4—Integrating Science Practices With Common Core Literacy Strategies**
- **PDI 5—Deepening Thinking and Reasoning Through Discussion and Writing in K–5 Inquiry-Based Science**
- **PDI 6—One-Day Work Session: Designing Effective Science Lessons Aligned to the NGSS**
- **PDI 7—One-Day Work Session: Developing Formative and Summative Assessments of NGSS Performance Expectations**
- **PDI 8—One-Day Work Session: NGSS 101: An Introduction to the Next Generation Science Standards**
NSTA’s 2014 STEM Forum & Expo
New Orleans
May 14–17*
* Evening Exhibits Preview & Reception—May 14

Program Highlights

**Wednesday**
Welcome Reception/Exclusive Exhibit Hours and Keynote Presentation

**Thursday and Friday**
Educator sessions, exclusive exhibit hours, a special Administrators panel on Thursday morning, and two invited panels that focus on:
- How to develop informal science education partnerships that support student success; and
- Indicators/metrics associated with building successful STEM programs.

**Saturday**
Closing Session with Student Panel Discussion

For updates, more information, and to register: [www.nsta.org/2014stem](http://www.nsta.org/2014stem)
Lesson 7: What Is Ethics in Science?

National Standards Met in Lesson 7

National Science Education Standards

Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Standard F: Science in Personal and Social Perspectives
- Personal health
- Risks and benefits

Standard G: History and Nature of Science
- Science as a human endeavor
- Nature of science

National Council for the Social Studies
- Social studies programs should include experiences that provide for the study of individual development and identity. (standard 4)

National Council of Teachers of English
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes. (standard 5)

Background for Teachers

An essential component of the middle school science curriculum is to introduce students to the relationships between science and ethics. Recently developed state and national goals, objectives, and standards stress the importance of including topics that incorporate ethics/values education in the science classroom. Often students have little to no experience learning about ethics and ethical issues placed within the context of science. Middle school students are at an important age for expanding their reasoning and logical skills, problem-solving abilities, moral values, and capacity for self-reflection.

Due to recent advances in areas such as biology, chemistry, medicine, and environmental science, society is continuously confronted with challenging ethical and social dilemmas about what is “acceptable.” Carefully and systematically analyzing various situations of ethical importance is an essential skill for students to develop.

The overall purpose of the unit is for students to work through the relationship of ethics issues and scientific work in our society. Students will learn about our society’s accepted guidelines for the ethical inclusion of animals in research, highlighting drug abuse research as a key example. As a result, students will be able to develop an understanding of the roles of science and animal models in developing treatments for drug abuse and misuse. To do so, students must first understand the concept of ethics. After introducing the key ethical principles, students begin to understand that while there is a lot of agreement among people regarding the importance of these principles, reasonable people can, and often do, come to different conclusions about what is and is not ethical.

Activity Three: Class Definition of Ethics

Procedure
1. For this activity, have the students brainstorm a list of words, terms, explanations, etc. of what they now believe the term ethics means. Write down the students’ responses until all ideas have been recorded, even if you disagree.
2. Ask the class to analyze the list and discuss the recorded ideas.
3. After the class agrees on a list of applicable concepts, ask the class to construct a revised definition of ethics and record their definition. The definition may include statements such as these:

   Ethics refers to ways of understanding and examining moral issues that are shaped by individual, community, and societal values. Ethical reasoning involves a systematic process that generates acceptable, justifiable choices or options.

   Students should also understand that ethics requires observation, awareness, reflection, experience, evidence, sensitivity, knowledge, and skill, and that ethics is sensitive to the values and contexts in which various questions arise.

Objectives

After completing this lesson, students will be able to
- clarify their understanding of the term ethics;
- demonstrate an understanding of the following terms: autonomy, beneficence, compassion, justice, non-maleficence, veracity, and bioethicist;
- listen critically to the opinions and arguments of others;
- develop a concise and thorough definition of ethics;
- use analytical skills to explore and evaluate their understanding of ethical issues and principles in hypothetical situations; and
- exhibit an increased sense of personal and social responsibility.

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 This Is Your Brain: Teaching About Neuroscience and Addiction Research, by Terra Nova Learning Systems, edited for publication here. To download the full text of this chapter, go to http://bit.ly/1ebBrAY. NSTA Press publications are available online through the NSTA Science Store at www.nsta.org/store.
Tap into the incredible network of the National Science Teachers Association with the NSTA Science Supply Guide. Powered by MultiView, the Guide is the premier search tool for science educators. Find the supplies and services you need, within the network of the association you trust.

Start your search today at:
www.nstasciencesupplyguide.com / www.nsta.org
March 18—Design challenges engage students through hands-on activities with real-world applications. Find out how to use water safety in space to hook students into learning about engineering design, Earth systems, and Earth and human activity during Engineering Design Challenge: Water Filtration, a free NSTA Web Seminar. The session runs at 6:30–8 p.m. Eastern Time (ET). For more information or to register, visit http://bit.ly/Eo1MU.

March 20—Find out how you can challenge your students to discover what Mars’ ice is made of during Electromagnetic Spectrum: Remote Sensing Ices on Mars, a free NSTA Web Seminar. The activity, which addresses the Next Generation Science Standards (NGSS), allows students to use data collected by the Mars Odyssey spacecraft to investigate the composition and distribution of ices on the red planet. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

March 24—Learn how to use NASA resources and engineering design challenges to engage students while addressing the NGSS during Introduction to the Engineering Design Process, a free online course from NSTA and NASA Explorer Schools. The course will continue through April 18. Participants who complete the required components for this module and a second, implementing the Engineering Design Process in Your Classroom, can earn a certificate acknowledging 15 hours of effort. Graduate credit is available for a fee. Visit http://bit.ly/1dfQT6f for more information or to register.

March 26—Learn how to combine Common Core State Standards for mathematics and science concepts during Geometry: Space Math Problems—Solar Storms, a free NSTA Web Seminar. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

March 31—Educators of students in grades 6–8, don’t miss this chance to learn more about student rocketry while making connections to the NGSS during Center of Mass and Center of Pressure: Engineering a Stable Rocket, a free NSTA Web Seminar. The session runs at 7:30–9 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 1—Bring science and math together with a dash of space science to pique your students’ interest with a free NSTA Web Seminar, Percentage and Volume: Space Food and Nutrition—How Much Is Waste? Participants will learn how students can use ratios to compare the mass and volume of packaged food before and after repackaging for spaceship and determine the usable and waste portions. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 9—Educators can learn how to incorporate concepts from the Common Core State Standards, Mathematics, and the NGSS into their curricula during Heat, Temperature, and Energy: MESSENGER—Cooling With Sunshades, a free NSTA Web Seminar. The session includes an overview of the Cooling With Sunshades student activity, information on required materials, and ideas for modifying the activity to teach the engineering design process while covering content. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 10—Your students experience weather every day, but how often do they really analyze it? Learn how to use data from Geostationary Operational Environmental Satellites (GOES) and Polar Operational Environmental Satellites (POES) into your meteorology lessons during Weather and Climate: Satellite Meteorology, a free NSTA Web Seminar. Targeted to educators of students in grades 7–12, the session makes connections to national science and technology standards, including the NGSS. The session runs at 7:30–9 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 15—How are bones affected by living in space? Find out during Human Body: Space Adaptations, a free NSTA Web Seminar. Teachers of grades 4–8 will learn about how space affects astronauts and how this research can lead to a better understanding of Earth-based conditions, such as osteoporosis. Lessons included in the session address NGSS and incorporate science, technology, and mathematics. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 17—Educators of grades 8–12, don’t miss Engineering Design Challenge: Thermal Protection System, a free NSTA Web Seminar that demonstrates how to incorporate NGSS into your curriculum. In addition, you will learn about NASA research on a promising new thermal protection system called the Hypersonic Inflatable Aerodynamic Decelerator. The session runs at 6:30–8 p.m. ET. For more information or to register, visit http://bit.ly/Eo1MU.

April 21—Don’t miss the start of Implementing the Engineering Design Process in Your Classroom, a free online course from NSTA and NASA Explorer Schools. The second module of Teaching Tomorrow’s Engineers will guide participants as they reflect on their learning and create an engineering-focused professional development plan. The course will continue through May 9. Educators must complete Introduction to the Engineering Design Process (see March 24 listing) to be eligible to enroll. Attendees who complete the required components for this module and Introduction to the Engineering Design Process can earn a certificate acknowledging 15 hours of effort. Graduate credit is available for a fee. Visit http://bit.ly/1dfQT6f for more information or to register.

Index of Advertisers

Acadia National Park, http://schoolscinstitute.org/education-programs 16
 Carolina Biological Supply, 800-334-5551, www.carolina.com 28
Howard Hughes Medical Institute, www.biointeractive.org 11
National Earth Science Teachers Association (NESTA), www.nestanet.org 17
National Science Teachers Association, 800-722-8700, www.nsta.org 4, 12, 13, 14, G6, 18, 20, 22, 24, 26
PASCO scientific, 800-772-8700, www.pasco.com 5
Project Learning Tree, www.plt.org 8
TOPS Learning Systems, www.topscience.org 4
NSTA's elementary-level journal Science and Children (S&C) is devoting a special thematic year to the seven crosscutting concepts identified in the Next Generation Science Standards (NGSS). The NGSS state these crosscutting concepts in the grade-level foundation box and connect them to disciplinary core ideas for specific grade levels. A Framework for K–12 Science Education considers crosscutting concepts to be fundamental to understanding the nature of science.

This year in S&C, articles will examine each crosscutting concept. The editors are seeking manuscripts that explain how each concept is deliberately developed and revisited, including cause and effect: mechanism and explanation; scale, proportion, and quantity; systems and system models; energy and matter: flows, cycles, and conservation; structure and function; and stability and change.

Does your teaching incorporate concepts that overlap many science disciplines? Share your successful strategies with your elementary colleagues by submitting manuscripts for one or more of these special issues. Deadlines extend through November 1. Read more about this call for papers at www.nsta.org/elementaryschool, or write to Linda Froschauer (fro2@mac.com) for more information.

Quotable

You can know the name of a bird in all the languages of the world, but when you’re finished, you’ll know absolutely nothing whatever about the bird...So let’s look at the bird and see what it’s doing—that’s what counts.


Live Animals Ready To Roll

Talk about convenience. At Carolina, we ship our living materials 5 days a week- to make sure they arrive alive on the day you need them.

The Carolina Experience