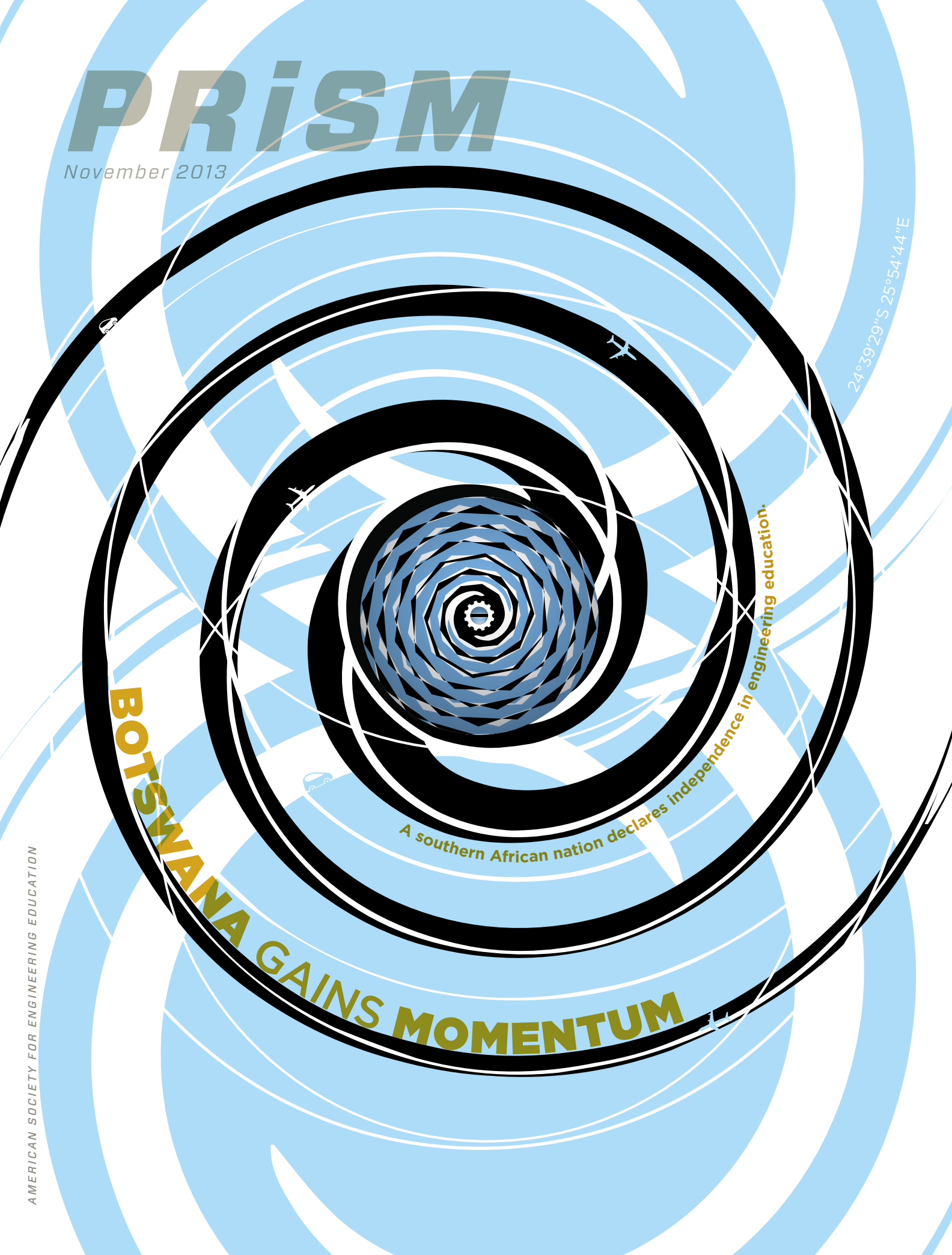
PRiSM
November 2013



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BOTSWANA GAINS MOMENTUM

A southern African nation declares independence in engineering education.

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Live Webinar for Engineering Educators

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Application of Advanced Online Testing Solutions in a Freshman Engineering Computation Lab

Wednesday, October 16, 2013 | 10:00 am ET

Every engineering professor inevitably confronts the problem of how to test and assess a large number of students all at once. The amount of time required to manually grade tests can deprive students of adequate time for quality face-to-face instructor interactions. On top of the need to effectively test their students, professors also have an obligation to accurately assess what their students are learning, along with their ability to apply classroom theory to solving real-life engineering problems.

This webinar presents a detailed case study of how Dr. Bruce Char and his colleagues at Drexel University overcame the challenge of effectively testing and assessing ~900 students/year using advanced technology solutions in a freshman engineering computation lab. The key new element was the introduction of a web-based testing solution that made it possible to deliver meaningful tests on any subject involving technical content to a large group of engineering students simultaneously.

In this webinar we will illustrate how you can reinforce engineering concepts while effectively testing and assessing students using a combination of programming, modeling and simulation, and advanced testing technologies.

The contents of this webinar include:

- Motivation and the core pedagogy framing the initiative
- Fundamental elements of the freshman engineering computation lab
- Technical challenges in introducing advanced testing and assessment tools into the freshman curriculum
- Progress thus far and future challenges and goals

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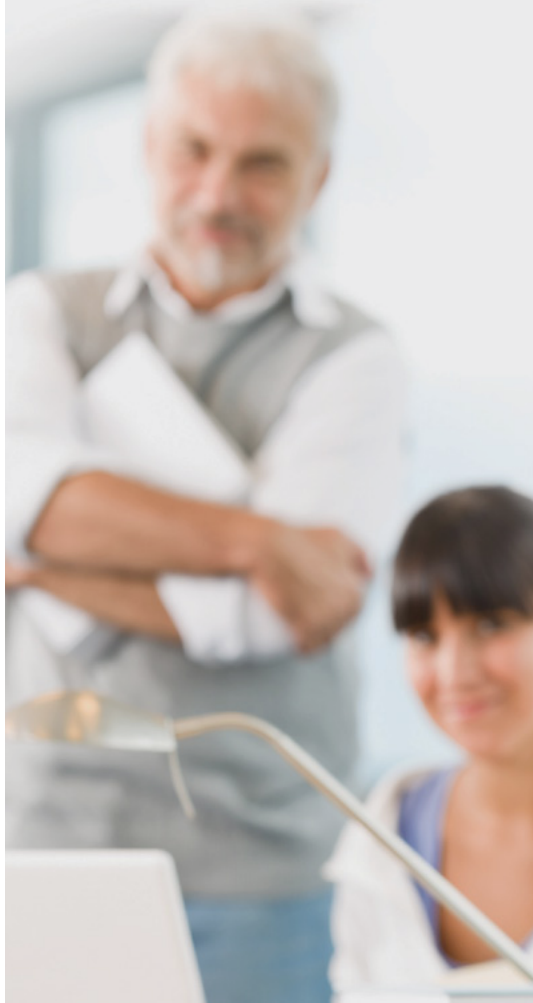

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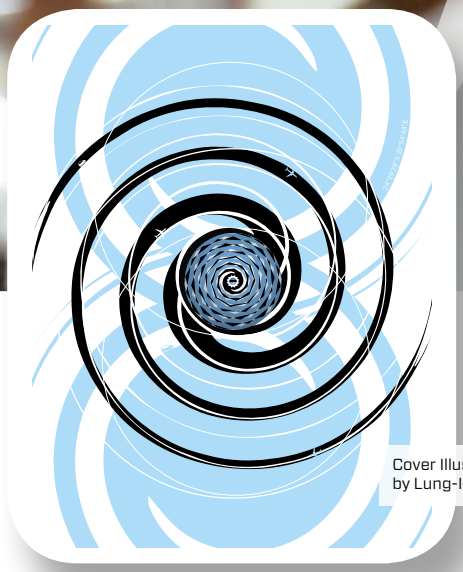

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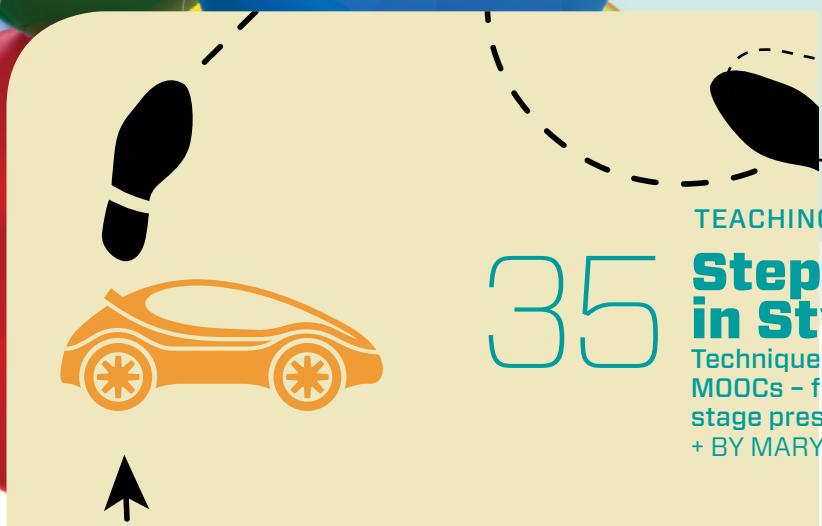

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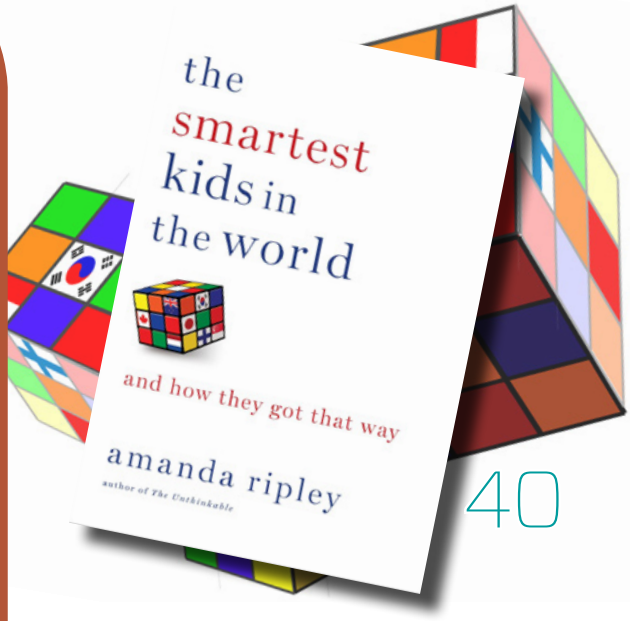

PRISM
AMERICAN SOCIETY FOR ENGINEERING EDUCATION
NOVEMBER 2013 Vol. 23 No. 3

Growth Spurts

The "resource curse" is a term commonly applied to countries living so comfortably off underground treasure that they fail to develop the infrastructure, educational systems, and innovation capacity to prosper without it. In Africa, the benefits redounded, first, to colonial powers, and later to well-connected elites and international commercial interests. Botswana, blessed with diamonds and other natural wealth, has escaped the curse with a combination of sound governance and native-born engineers trained in Europe and the United States. Now it's ready for the next step: training engineers at home. As Don Boroughs explains in our cover story, Botswana is able to draw on a longtime connection with the Missouri University of Science and Technology and a government prepared to spend on faculty and labs. The country also has set up competition between the established University of Botswana and the new Botswana International University of Science and Technology. It's an inspiring story.

The call for engineers in Botswana echoes one frequently sounded in this country by both industry and the White House, which has exhorted U.S. universities to graduate 10,000 more engineers a year. The coming retirement of baby boomers has many concerned that companies will be forced to recruit overseas. But some economists dare to disagree, as Beryl Benderly recounts in our feature "Boom or Bubble?" They argue that even with baby boomer retirements, we're unlikely to face an engineering shortage. Furthermore, they contend that the kind of innovation on which the nation depends to stay competitive won't come from more engineers but from more investment in research and development. Their views deserve a hearing as a number of engineering schools expand.

Like it or not, there seems to be no stopping the MOOC wave, and some engineering faculty members are riding it with enthusiasm. They've been at it long enough that they're ready to pass along some tips to colleagues just getting their feet wet. Mary Lord's story "Step Online in Style" is both well-told and timely.

A correction: Gary Bertoline has been dean of Purdue's College of Technology since July 2011, not 2002 as we incorrectly reported in September.

We hope you enjoy the November *Prism*, exuberantly illustrated by Lung-I Lo, Nicola Nittoli, and Francis Igot. Please contact us with comments.

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Algorithms

WALKING ON AIR

Taking computer-aided design to new heights, Italian architect Arturo Tedeschi and computational designer Maurizio Degni created Cloudbridge, a conceptual pedestrian span of delicate mesh that seems to float between two mountains. The pair set out an arbitrary, nonlinear path, and programmed dimensions, weights, and construction constraints into a computer. An algorithm then generated a 3-D grid that balanced the path's asymmetric loads. "Before the algorithm computes the solution, the final shape is unknown," Tedeschi says. The intent is to "reach an optimized structure where art and technique merge." He envisions using digital fabrication technology to build the steel structure in clusters of square sections joined together. As for testing its strength and durability, he says, "We will rely on engineering and consulting services firms which have avant-garde laboratories to test the behavior of complex structures." Cloudbridge has drawn the attention of *Wired* and Phaidon, a publishing house and blog specializing in art and architecture. There are, Tedeschi claims, "some interesting proposals from private investors." – *Mark Matthews*

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Sci-Fi Cinema

Artistic License

Alfonso Cuarón's *Gravity*, a 3-D thriller about two astronauts (played by Sandra Bullock and George Clooney) who get stranded when debris destroys their spacecraft, has drawn critical acclaim for its beautiful – albeit computer-generated – views of deep space. But some experts fault the film for scientific inaccuracies. Writing for Time.com, astronaut Marsha Ivins catalogued a host of errors, from the altitude of the broken satellites that cause the ship to break apart to the seeming indestructibility of the stars' space suits. In an interview with *Wired*, Cuarón says he tried to be as scientifically accurate as possible but "needed to take certain liberties" to tell the tale. That's fine with Cady Coleman, the real scientist/astronaut who advised Bullock about life in space. She told *Popular Science* that the movie "shows a lot of things very accurately." She cuts the director some science slack because the movie is mainly a human drama that happens to be set in space, not true sci-fi. Coleman, who met Sally Ride, the first female astronaut, in college, also is ecstatic that *Gravity*'s popularity could encourage more girls to become astronauts: "It's very meaningful to me that the hero in this movie is a woman."– *Thomas K. Grose*

© NASA

Marsha Ivins

Privacy

False Font

The National Security Agency's ability to break encryptions and sift through email and other digital data has been in the headlines since ex-contractor Edward Snowden began a leak spree. Now another former NSA contractor, Sang Mun, has developed a typeface he calls ZXX that he says can thwart machine readers but remains comprehensible to humans. ZXX comes in four fonts: Camo, False, Noise, and Xed. Mun, a U.S.-educated South Korean who worked on codes for the NSA while serving his two-year military obligation back home, told Wired he was motivated to design ZXX by Google Glass – a wearable computer that resembles a pair of glasses – and other Google scanning technologies that he considers intrusive. Two computer scientists, however, told CNN that the fonts could easily be cracked, especially by the NSA. It might confuse standard optical character recognition (OCR) programs, says Matthew Green of Johns Hopkins University. "But if the NSA really wants to detect this data? Not really." OCR allows Google and others to read and digitize printed words. CNN quotes Mun as saying that the typeface is "a call to action" that aims to "raise questions about privacy." Apparently, it's more an act of protest than protection. – *TG*

© Sang Mun/ZXX

K-12 Stem Education

Do the Math

© PBS

PBS Kids, the public television network's educational division, drew an impressive 80 percent of kids ages 2 to 8 with its lineup of *Sesame Street* and other popular shows during the 2011-12 season. But online games and mobile apps are drawing an increasing share of eyeballs. To help prepare children for kindergarten – and perhaps prime some for STEM careers – PBS Kids has launched a new show aimed at teaching math to tots 3 to 5 years old. *Peg + Cat* features a rounded-headed, red-haired girl and her feline friend who have adventures that require solving problems using math. Along with the program, PBS is unleashing a plethora of *Peg + Cat* online games and videos. Given the huge number of educational apps already available, and the head start in the marketplace that giants like Disney and Fisher-Price have, Peg plus her cat may have to count on quickly charming millions of preschoolers in a crowded commercial space. – *TG*

Alternative Energy

Power Pathway

© GWU

Sidewalks can soak up lots of sunshine, so why not put that solar energy to use? That was the thinking behind a new, 100-square-foot walkway constructed of 27 solar panels that was recently unveiled at the George Washington University's Virginia Science and Technology Campus. The semitransparent panels can, under perfect conditions, generate 400 watts of power, which is used to illuminate the sidewalk's 450 LED at night. The tough, slip-resistant panels were designed and built by Onyx Solar, a Spanish photovoltaic technology company that sometimes takes on such unusual projects as creating America's largest integrated photovoltaic skylight, which sits atop Novartis Pharmaceuticals' New Jersey headquarters. The university also installed a solar trellis created by Studio39 Landscape Architecture that generates electricity to help light Innovation Hall, a nearby building. The "sustainable Solar Walk," as it's called, seems like a bright idea. But will snow dim the lights? – *TG*

Biometrics

Telltale Heart

Security systems that use a person's DNA, iris, or other distinctive biological characteristics took a big leap from James Bond fantasy into the mainstream with the introduction of the iPhone 5S in September. The device features a fingerprint sensor to confirm the user's ID. Just two days after Apple's latest debut, however, a group from Germany's Chaos Computer Club hacked the protection. That only stoked Toronto-based Bionym's quest to take biometrics to the next level with some human marker that cannot be photographed or copied. Its Nymi wristband is outfitted with an electrocardiogram sensor that authenticates a person's identity by his or her heartbeat and transmits the information to a computer or smartphone. Bionym's founder and CEO, Karl Martin, hopes his device will not only replace passwords but also enable wearers in future "smart" environments to unlock the car or pay for a meal with the wave of a hand. – *Pierre Home-Douglas*

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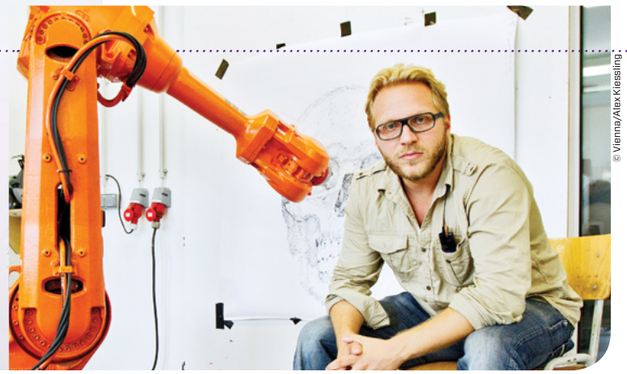


© Vienna/Alex Kiessling

Remote Control

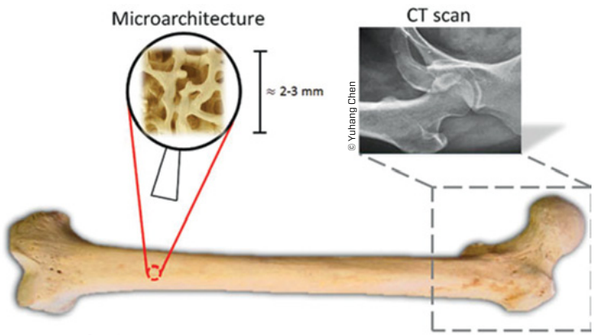
Hidden Hand

Recent passersby in London's Trafalgar Square and Berlin's Breitscheidplatz may have been startled to see an industrial-size robot drawing a portrait on a canvas. Was there a ghost in the machine? Nope. Each bot was simultaneously following the lead of Austrian artist Alex Kiessling as he sketched out the drawing -- a portrait of one full face between two half-heads he called "hybrid head" -- at a gallery back in Vienna. Kiessling claims it is the first work of art to be created in three different places at once. An infrared sensor was attached to his pen, which sent signals, via a computer and a satellite link, to the two bots in London and Berlin. Whatever he drew, they drew. The 33-year-old artist says it took him six months to perfect the technique and write the software for the project he dubbed "Long Distance." Kiessling, who's been fascinated by robots since childhood, says the project blurs the line between what's original and what's a copy. All three versions of "hybrid head" will be attached into a triptych, and exhibited in Vienna and London. Not, however, simultaneously. – *TG*

Biomedical Imaging

Aging Hipsters

Broken hips can be a life-threatening experience for seniors. In the United Kingdom, for instance, fully one quarter of patients over the age of 65 don't survive a hip injury. To help reduce that fatality rate, a multiuniversity team led by biomechanical engineering researchers at Edinburgh's Heriot-Watt University is developing a diagnostic tool to determine if elderly patients' bones are fragile before they suffer a fracture. The method uses advanced imaging techniques that peer inside bones on a microscopic level to figure out the quality and strength of the tissue. Current diagnoses are made using radiography that merely measures mineral density, but bone is not wholly composed of solid materials. A device that measures porousness and how well bone tissue at the microscopic level handles daily loads could help patients better manage the wear and tear on their bones throughout their lives. Having better insight into the state of aging bones also could lead to more effective treatments for breaks. – *TG*



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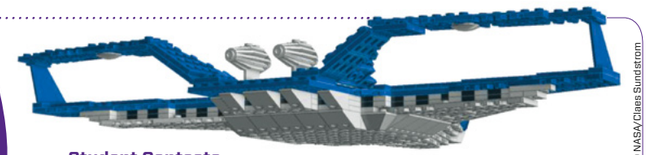

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Student Contests

Sky's the Limit

NASA is always on the lookout for new aircraft design ideas, and it's also an enthusiastic partner in a lot of educational activities, particularly those set up to encourage budding engineers. So it recently held a contest that combined the two missions. It asked students ages 13 to 18 to design one of two types of craft: either a next-generation airplane that used shapes and technologies to increase efficiency and cut emissions and noise, or a futuristic space vehicle. Beyond sketching out their concepts, contestants had to construct their designs using LEGO, the popular toy building bricks. The results looked very cool. The winner of the aircraft category, Claes Sundstrom of Sweden, came up with a hydrogen-powered regional airliner that could carry 189 passengers and cover 3,500 miles. It has a manta-ray-like blended-wing body. Judges wrote: "We can see this type of plane flying through our skies in the near future." Britain's Jay Semlis won the spacecraft category with his *Sunbeam*, an unmanned ship designed to probe the outer regions of the sun's corona. America's William Nodvik won the young student builders' category for his Flying Extinguisher 4000 *Fish Eagle*, a tanker capable of vertical take-offs that would be used to fight wildfires. – *TG*

© NASA/Jim Banke

Autonomous Vehicles

Home, James!

Are driverless cars coming to a street near you? Just five years ago, Carnegie Mellon University researchers unveiled an SUV that could safely steer itself at speeds of up to 14 mph. Google's autonomous cars – a Toyota and a Lexus – began cruising last year. Then, in September, CMU engineers put pedal to the metal, sending a self-driving Cadillac SRX to whisk Pennsylvania Congressman Bill Shuster from the town of Cranberry to a press conference at the Pittsburgh airport some 33 miles away. CMU's Caddie can not only reach highway speeds but also change lanes, handle traffic, and stop for lights and signs thanks to a computer under the floorboards that processes massive amounts of data from radars, remote sensors, and infrared cameras. CMU researchers say falling equipment costs will make autonomous cars commercially viable within five years, but consulting firm KPMG says this "profoundly disruptive" technology will hit the fast lane sooner than most people expect. Advances to come include radar, which now is heavy and requires the scanner to constantly move. A Duke University researcher has devised an inexpensive metamaterial that could produce radar images using a static scanner. While every major automaker is working on self-drive technologies, automatic collision-avoidance systems are likely to debut before driverless cars. Ford is testing a system in Germany that takes control of a vehicle to avoid a crash if it senses that the driver isn't acting quickly enough. – *TG*

© Carnegie Mellon University

Robotics

Tumbling Blocks

Are M-Blocks some sort of new electronic toy? Viewers of a fun video of the energetic, cube-shaped robots in action would certainly be excused for thinking so. But M-Blocks are no playthings. Designed by researchers at MIT's Computer Science and Artificial Intelligence Laboratory, the cubes have no external moving parts. Nevertheless, they can leap and roll and climb over one another, and link themselves together into countless configurations. Inside each cube-bot is a flywheel that spins at 20,000 revolutions per minute. When it's braked, it creates a momentum that sets the cube into motion. The cubes have eight small magnets on each side, which they use to attach themselves together.

© M. Scott Brauer

Their edges are each lined with a spinnable rolling-pin-shaped magnet that enables them to flip themselves atop one another. Currently the researchers control the cubes using computer commands sent via WiFi. But they anticipate that at some point they'll be able to load algorithms into the blocks that will allow them to act autonomously. Ultimately, it's hoped that the M-Blocks can be miniaturized into swarms of self-assembling microrobots. But even at their current size, the MIT researchers say, the cubes could assemble themselves into useful, temporary objects — chairs or ladders, for instance — or be used to make temporary repairs to damaged bridges or buildings. – *TG*

Women in Engineering

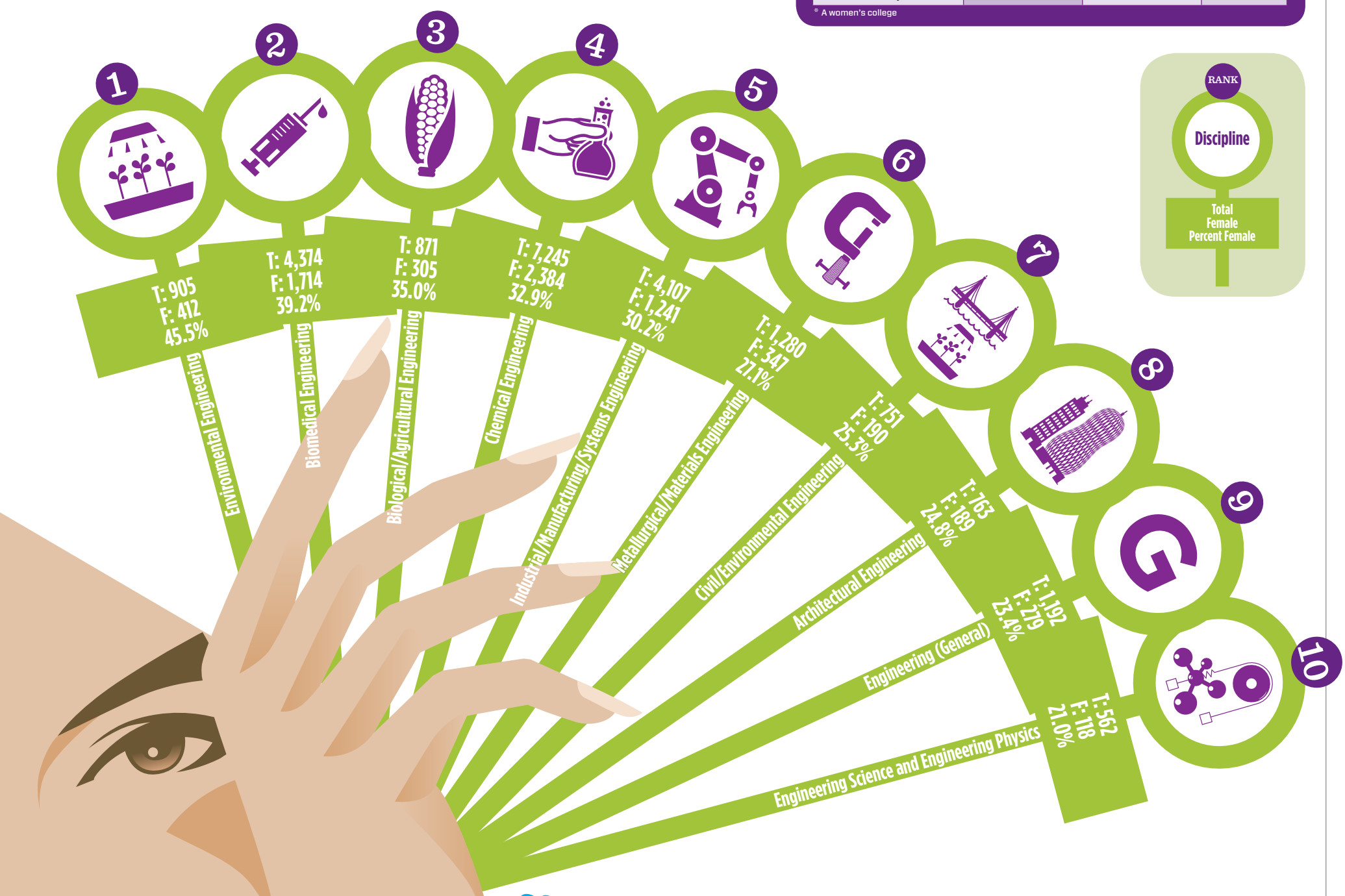
The following tables show, in rank order of percentages, the top 10 engineering disciplines that awarded bachelor's degrees to women in 2012, and schools with the greatest and smallest proportions of female engineering graduates in the same year.

Top 10 schools in percentage of women awarded a bachelor's degree in 2012

School	Number of bachelor's degrees awarded	Share awarded to females	Rank
Smith College*	20	95.0%	1
Franklin W. Olin College of Engineering	82	46.3%	2
Howard University	66	42.4%	3
Massachusetts Institute of Technology	612	41.7%	4
Tuskegee University	46	41.3%	5
William Marsh Rice University	250	41.2%	6
The George Washington University	112	41.1%	7
California Institute of Technology	134	40.3%	8
Harvey Mudd College	65	38.5%	9
Yale University	68	38.2%	10

* A women's college

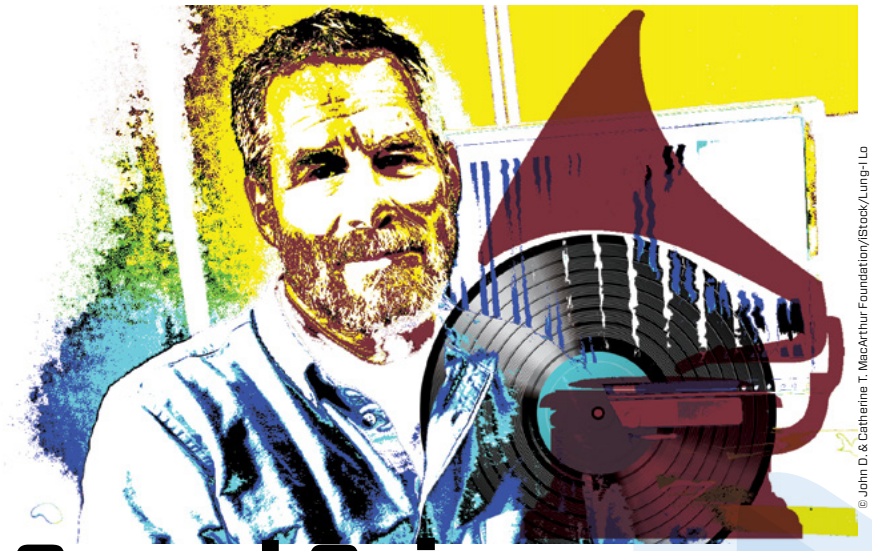
Rank order, by percentage, of bachelor's degrees awarded to women by engineering discipline in 2012



Lowest 10 schools in percentage of women awarded a bachelor's degree in 2012

School	Number of bachelor's degrees awarded	Share awarded to females	Rank
Minnesota State University-Mankato	74	5.4%	319
University of North Florida	80	5.0%	320
Saginaw Valley State University	40	5.0%	321
Southern Polytechnic State University	48	4.2%	322
University of Tennessee-Martin	25	4.0%	323
The Citadel	87	3.4%	324
York College of Pennsylvania	31	3.2%	325
Virginia Military Institute	75	2.7%	326
Wentworth Institute of Technology	38	2.6%	327
Arkansas Tech University	63	0.0%	328

Infographic by Lung-I Lo



Sound Science

An experimental physicist gives history back its voice.

BY SARAH KHAN

On the Smithsonian Institution's website is an audio track of Alexander Graham Bell, one of the first people to record sound, saying his own name and trilling loudly.

Bell recorded his voice over a century ago on a wax and cardboard disc. Audio preservationists feared it had become unplayable because of its condition and age. But physicist Carl Haber brought Bell's voice to the present day. A lead scientist at Lawrence Berkeley National Laboratory in California, Haber has been working for the past 10 years to prevent some of the world's oldest recordings from being lost forever. He recently won a MacArthur Foundation fellowship, joining 23 others, including jazz pianists, writers, economists, and mathematicians, who will each receive $625,000 over five years to advance societal, cultural, or human rights causes.

Haber joined the lab in 1986, a year after completing a Ph.D. in physics at Columbia University. He mainly develops instruments for detecting the shapes and positions of subatomic particles that are shot out from collisions inside high-energy particle accelerators, such as the Large Hadron Collider at CERN in Switzerland. Those devices include a high-resolution camera that Haber has adapted for audio restoration projects. The camera takes thousands of detailed photos of a fragile record whose grooves can no longer withstand the pressure of a stylus from a playback machine. The photos are then stitched together and fed to computer software that simulates a turntable's needle following the recording's bumps and grooves. The result is an audio file – a digital backup – of voices from cultures and societies past.

Haber uses a similar method for three-dimensional objects, like cylindrical wax recordings that he says were popular with early experimentalists like Bell. Versatility is important, Haber said, since early recordings were hardly ever made on traditional vinyl. Bell's recordings were done on many different media, including metal, wax, glass, paper, plaster, foil, and cardboard, according to the Smithsonian Institution.

"As long as we can image the object, we have a lot of flexibility with what media we can work with," Haber says. "We're basically just taking a picture of the recordings, and the differences come out in the way the software handles it." The approach is named IRENE, for "Image, Reconstruct, Erase Noise, Etc."

Each project poses engineering challenges to Haber's team, which at times has enlisted help from Berkeley engineering undergraduates. For instance, lasers must precisely control the movements of the camera and the analog recording in order to keep the camera's depth of field – on the order of microns – constant. Additionally, the computer software needs to know how to detect and eliminate bumps, cracks, and other discontinuations that would affect playback. Haber hopes some of the MacArthur money will allow his team to refine techniques for preserving severely damaged or broken media.

Haber's efforts have brought hundreds of century-old collections from the Smithsonian Institution and the Library of Congress back to life. His team also works with smaller institutes, such as the Northeast Document Conservation Center in Massachusetts, where a 3-D imaging system is being built to digitize more than 1,000 samples of New England folk songs and lore recorded in the 1930s and '40s. In 2008, Haber and colleague Earl Cornell revived the oldest known voice recording, a 10-second paper phonautogram, made in 1860, of the folk song "Au Clair de la Lune."

Haber's team has recently begun work on 1930s aluminum disc recordings by Harvard classicist Milman Parry of Slavic oral stories and poems. Important in illustrating the structure of such poetry and relationships between individual poems, the discs are difficult to play manually without damage and need digital sound restoration to preserve the audio.

Haber said that physics research often affects other fields, including medicine, industry, and computing. Spinoffs such as audio restoration are considered worthwhile by the Lawrence Berkeley lab, which operates within the Department of Energy's Office of Science, because of their overall benefit to society. His project, however, has been largely supported by funders outside DOE.

Until now, preservation science has mainly been the domain of chemists, who lend their expertise to stabilizing antiquities, Haber says. "With sound restoration, there are more places where physicists, electrical engineers, and computer scientists can participate."

Sarah Khan is assistant editor of Prism.

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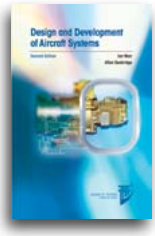

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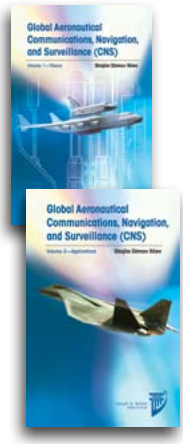

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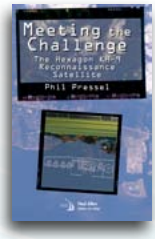

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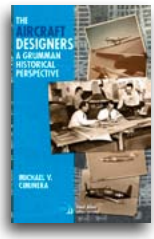

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Changing Tires

An oft-told tale reveals a legendary teacher's humor and fairness.

One of Duke's most celebrated teachers passed away last spring, and his half century in the classroom was recalled warmly in press releases, obituaries, and blogs.

James Bonk was a professor of chemistry, and he was said to have taught first-year chemistry to more than 30,000 students during his career. The course sequence consisting of Chem 11 and Chem 12 was so closely identified with him and his distinctive style that these general chemistry courses had long been referred to collectively as Bonkistry.

Bonk came to Duke at a time when it was still possible to have a very successful career as a teacher without a grant-laden research portfolio, and he rose through the ranks accordingly. He was more than a chemistry teacher, however, serving as a volunteer coach for the men's varsity tennis team for over two decades and as its academic adviser to the end.

Bonk was infamous for his exams and quizzes, which continued to haunt students long after they had become alumni. His Friday quizzes were especially notorious. One alumnus blamed them for "an entire year of ruined Thursday nights," because he had to study chemistry instead of beginning a long weekend of partying. Another alum, 20 years after graduation, admitted to still getting nightmares about not being prepared for a Bonk test.

One oft-told anecdote about Professor Bonk's personality is known as the "flat-tire story." It involves four students who, instead of studying the weekend before the final exam in Bonkistry, went to Virginia to party. They evidently had a great time, returning to campus just before the Monday morning test. Since they were unprepared, they told Professor Bonk that they had a flat tire on the highway and discovered there was no spare. The delay caused them a great deal of consternation just before the exam, and they asked if they could postpone taking it.

EXCUSES MIGHT BE ACCEPTED, BUT DON'T EXPECT THEM TO GO UNCHALLENGED.

Since the students had done well all semester on their exams and quizzes, and since each was going into the final with a solid A grade, Professor Bonk accepted their excuse and rescheduled the test. If they had indeed had a flat tire while driving back to campus, they should be allowed to recover their wits before sitting down to take the final. But what if they had concocted the story of the flat tire?

When the day to administer the exam arrived, Bonk assigned each of the four students a different room and handed out the test. It consisted of just two questions: The first was relatively easy and was worth 5 points; the second was considered potentially more difficult and was worth 95 points. It asked, in full, "Which tire?"

The story does not need to go any further in demonstrating Professor Bonk's sense of humor, fairness, and justice. The mere telling of the story was a sufficient word to the wise that excuses might be accepted, but don't expect them to go unchallenged.

Variations on the flat-tire story have circulated among students at other schools, but often associated with an unnamed instructor of an unnamed course. I like to think that the specificity of the Duke version, and its consistency with the personality of Professor James Bonk and the nature of his Bonkistry course, make it ring true.

When Professor Bonk stepped down from teaching his freshman courses in 2001, Duke's president presented him with basketball jerseys bearing the chemistry course numbers 11 and 12, signifying that they had been retired. Just as subsequent recruits aren't expected to fill the jersey of an outstanding player, no other teacher can continue Bonkistry's legendary run.

Henry Petroski is the Aleksandar S. Vesic Professor of Civil Engineering and a professor of history at Duke University. His most recently published books are An Engineer's Alphabet: Gleanings from the Softer Side of a Profession *and* To Forgive Design: Understanding Failure.

Photo by Catherine Petroski

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Interrupt the 'Forced March'

Giving students time to think will better prepare them for challenges they will face as engineers.

What do your students do after they finish a project or turn in an exam? If they're like most engineering students, the answer is "Breathe a quick sigh of relief and move on to the next thing." Especially in engineering education, where the emphasis is often on how much content can be crammed into a course, students rarely get the opportunity to reflect on their learning. As my colleague Mark Somerville puts it, "Engineering education can be like a forced march up a mountain, and when you get to the top, you aren't even allowed to stop and take in the view."

But reflection isn't just about stopping and smelling the roses. It's a fundamental part of learning.

REFLECTION IS A FUNDAMENTAL PART OF LEARNING.

In the experiential learning model developed by David Kolb, an organizational behavior specialist, our experiences of learning are a combination of perception (thinking and feeling) and processing (doing and watching). The learning cycle consists of four waypoints: concrete experience (feeling), reflective observation (watching), abstract conceptualization (thinking), active experimentation (doing), and then back to concrete experience and continuing around. We're used to thinking of reflective observation as a starting point – "watch me as I do this"– but Kolb argues that it's part of a cycle; that reflection is just as important after the "doing" phase as it is at the start. Being conscious of allowing time and space for reflection can therefore help learners absorb and retain material.

But there is a deeper reason to foster reflection in our students, one outlined in Donald Schön's *The Reflective Practitioner.* In it, Schön argues that education in the professions, including engineering, focuses on what he calls Technical Rationality, "instrumental problem solving made rigorous by the application of scientific theory or technique." But when we observe skilled practitioners of engineering and design, we see them using an enormous amount of tacit knowledge that they can't necessarily articulate, which Schön calls knowing-in-action. When these practictioners come across a situation that involves "uncertainty, instability, uniqueness, and value conflict," they draw upon reflection-in-action – thinking about what they are doing, both tacitly and explicitly. As we move away from the idea of engineers as just focusing on the technical components of their work and towards a model of engineering as deeply engaged with people, the ability to reflect on one's work and learning will be even more crucial.

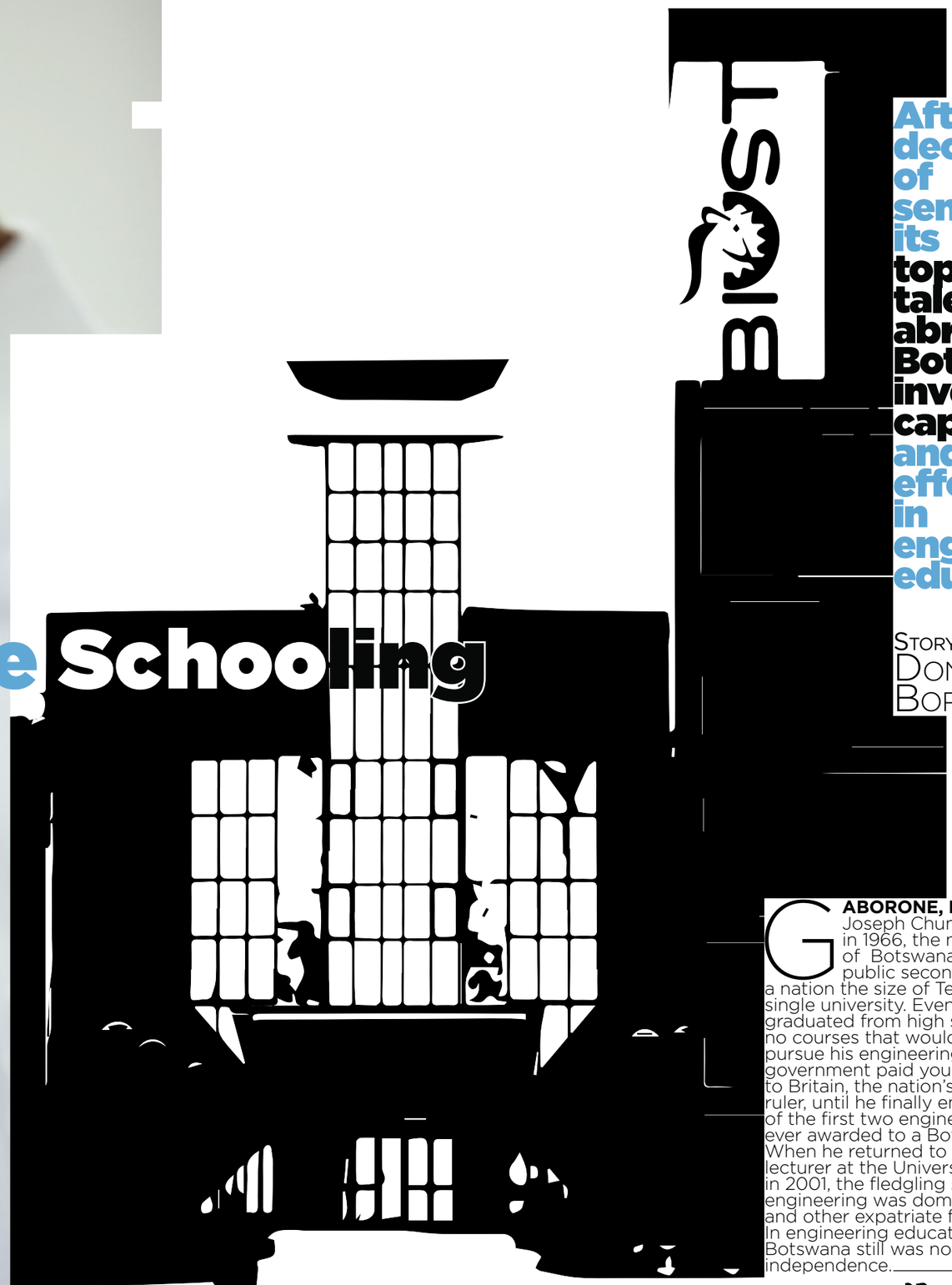
So how do we develop this in our students? Reflection has long been part of both the design process and design education. In the first-year engineering design course at Olin College, students build an experimental prototype, and then film a video reflection of what works well, what needs to be improved, and how they intend to redesign it for their final prototype. But reflection also can be incorporated into other types of engineering courses. At the end of a project, students can write "insight cards" — two or three rules of thumb that they would tell themselves if they could go back in time to the beginning of the experience. Students also can create "mind maps" of important concepts and ideas in a course, and how they relate to each other. It's especially useful to do this at the midpoint of a course and then revisit the mind maps again at the end, so students see how their understanding has changed.

Building opportunities for reflection into our courses will help our students learn but, more importantly, it will help them mature into thoughtful, reflective practitioners, capable of dealing with the broad array of technical and nontechnical factors they will inevitably face.

Debbie Chachra is an associate professor of materials science at Olin College. *She thanks Olin's associate dean for faculty affairs and development, Mark Somerville, for conversations leading to this piece.*

Photo by Michael Maloney/Olin College

Home Schooling



After decades of sending its top talent abroad, Botswana invests capital and effort in engineering education.

Story & Photography by
Don
Boroughs

GABORONE, Botswana – When Joseph Chuma was born in 1966, the new Republic of Botswana had just one public secondary school in a nation the size of Texas, and not a single university. Even by the time he graduated from high school, there were no courses that would allow him to pursue his engineering dreams. So the government paid young Chuma's way to Britain, the nation's former colonial ruler, until he finally emerged with one of the first two engineering doctorates ever awarded to a Botswana citizen. When he returned to Gaborone as a lecturer at the University of Botswana in 2001, the fledgling school of engineering was dominated by British and other expatriate faculty members. In engineering education, at least, Botswana still was not ready to declare independence.

The new campus of Botswana International University of Science and Technology (BIUST), which will open to students in 2014.

That time has now arrived. Chuma, the university's first Botswana-born dean of engineering, is involved in a radical transformation in the southern African nation that has brought the outsourcing of engineering education to a halt. Until last year, the government was still supporting hundreds of engineering students at universities abroad. At Chuma's urging, Botswana ended the long tradition in order to bolster its own engineering offerings. Mining engineering, which was subcontracted to the Missouri University of Science and Technology for several years, gradually is being transferred to Gaborone to develop domestic expertise for a nation built by diamond mines. Master's programs have sprung up in several departments. And this year, Chuma will confer the first doctorate of engineering ever to be granted on Botswana's soil.

Meanwhile, the new Botswana International University of Science and Technology (BIUST) will welcome the first engineering students to its sparkling campus in January. Says Chuma: "We're bringing it home."

The decision to educate nearly all engineers within its borders was so momentous for this developing country that it was extensively deliberated by President Ian Khama and his cabinet. Decades of lavish investment in overseas scholarships had paid off in a well-trained vanguard that helped make Botswana the fastest growing country in the world from its birth to the end of the 20th century. Before opting to pull the plug, recounts Marcus Maedza, director of the Department of Tertiary Education Financing, the president requested further information on placement trends of engineers educated both within Botswana and overseas.

"Twenty years ago we were a very poor country," notes Chuma. "Now we can achieve more, which is why we have taken this bold decision." Indeed, homegrown engineers are crucial to developing Botswana's economy beyond the diamond mines that currently supply about a third of GDP and the bulk of export revenues. Despite an abundance of steady sunshine and a national policy of promoting renewable energy, for example, solar power has yet to gain traction except for home water heaters and a 1.3-megawatt generator being built in Phakalane. Engineering opportunities also abound in helping the country tap substantial natural gas deposits discovered in the northeast.

A BIG SAVINGS

If nothing else, the move improves Botswana's balance sheet. Training an engineer locally never exceeds $5,400 a year, including living expenses in the capital city. But overseas courses set the government back $15,000 or more. Maedza, whose department covers university fees for all students at home and abroad so generously it commands a bigger budget than the entire Ministry of Defense, estimates Missouri S&T costs $54,000 annually per student. He calculates that the first year of keeping new engineering students in Botswana saved the public more than $70 million.

For universities, the benefit is measured in human capital. Year after year, Gaborone's engineering school would admit the top several hundred students who had completed their first year in mathematics, physics, and chemistry – only to see them head overseas on scholarships. "We would accept them in May, and by June they would be gone," recalls Chuma. The system was "unfair," acknowledges Maedza. "When we had skimmed off the cream of the 700, we were expecting his faculty to produce the best with those who remain." Today, rising enrollments – the number of new engineering students is up about 50 percent in two years – have strained departments, but Chuma is delighted to retain his country's top achievers.

University of Botswana students mixing cement for a slump test in the civil engineering lab.

About 170 miles northeast of the University of Botswana, an even bolder path for engineering education is taking shape on a hilltop outside the town of Palapye. Just beyond a village where goats and cattle wander across the dusty main road, an imposing $60 million campus of new, earth-toned buildings announces the arrival of BIUST.

While a Chinese construction company applies the finishing touches, the first cohort of BIUST students have been taking classes in temporary quarters at an underutilized Gaborone technical school. Some 250 of them, including about 175 engineering students, spent their first year learning from the science and mathematics staff and a solitary engineering lecturer. But BIUST is hiring nine engineering professors and five lecturers this year, and 60 more Botswana engineers have been sent overseas for graduate degrees with the aim of staffing the new institution. James Katende, dean of the College of Engineering and Technology, predicts that within a decade the public university will have 3,500 students, including hundreds of master's and Ph.D. candidates.

"We're all working seven days a week," says Acting Vice Chancellor Steven Howell, who joined BIUST from the mechanical engineering department at Lawrence Technological University in Detroit. "It's the most difficult job any of us have ever done." Howell likens the challenge of educating students while creating a new university to "flying an airplane while at the same time you are engineering and building the airplane."

It helps that BIUST has friends in high places. Ron Foster, an American engineering professor who heads the department of applied science, marvels at the robust budgets that are proposed and approved. "There is a political will behind BIUST," he says. "If the chancellor wants to walk into the office of the president of Botswana, he does." This is hardly surprising considering that Chancellor Festus Mogae headed the nation from 1998 to 2008. Notes Howell: "This is his baby; he is passionate" about seeing BIUST succeed.

Back at the University of Botswana, enthusiasm for BIUST is tempered. The school's management discouraged its creation when the government first proposed it nearly a decade ago, especially the suggestion that all engineering should be transferred to BIUST. That plan was dropped, setting up two competing engineering schools in a nation of just 2 million people. "It's a very sensitive area," acknowledges Chuma, who believes such expansion is "not necessary."

Unnecessary or not, BIUST's leadership sees plenty of evidence that the threat of competition already is shaking up engineering education for the better. Katende notes that the University of Botswana had never offered a doctorate in engineering. "Then

On Page 30: Energy engineering student Ogaufi Whitney Setlhogile, at BIUST's temporary campus.

we say we will emphasize graduate studies, and suddenly they are very eager to take on Ph.D.'s," he observes. BIUST also promised a department of mining engineering, which Katende believes helped spur the University of Botswana's decision to stop outsourcing the program to Missouri S&T.

Katende has spent most of his career in Nigeria, which has several schools of engineering. He believes that breaking up the monopoly in engineering education is the "number-one reason" Botswana needs BIUST. "Competition is useful in the knowledge industry," he explains. "It makes people sit up and make sure things get done properly."

University of Botswana professors acknowledge the potential benefits. Boipuso Nkwae, UB's head of civil engineering, expects there will be some duplication with BIUST's civil engineering department but welcomes the challenge. "I guess it's high time we started competing with others," he says.

Samuel Frimpong, chair of the Department of Mining and Nuclear Engineering at Missouri S&T, visits Botswana annually and calls the University of Botswana "a great university." If BIUST "grows to not only compete but also to collaborate, then the benefits will multiply."

Students are pleased to have a choice. Olekotse Hope Seretse turned down an offer from UB because BIUST accepted him straight into telecommunications engineering without his having to spend a year proving himself in math and science. Another member of BIUST's founding class, Itumeleng Kooletile, chose it over UB in part because of the location of the new campus. "It's going to be better away in Palapye," he says, "away from the disturbances of the city." Indeed, Howell says that the school had no trouble finding freshmen for the inaugural class. Of 2,500 applications, 1,500 exceeded the minimum qualifications. BIUST offered places to 300 students, and 267 accepted.

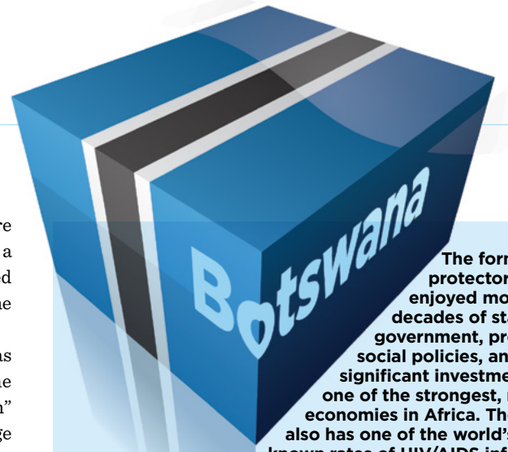
A NEW KIND OF ENGINEER

Dean Katende wants to mold those students into a new kind of African engineer – one who can hit the workplace running. "The big problem with the education of engineers in Africa is that we are very proficient in curriculum, mathematics, theory. Our students can go to the U.K. for a master's degree and finish within one year without a sweat," he says. "But if they go out to work in industry, industry tells us, 'You have turned out useless people for us; we have to train them from scratch.'" So BIUST emphasizes hands-on experience from the first year, with workshops and engineering drawing courses for freshmen. The five-year bachelor's degree requires six months of industry internships. "I want to train an engineer who goes out confident that he can touch any machine; these machines are not animals which might bite me," Katende explains. "You can only be better than a technician if you can already do everything a technician does. In Africa, you have to be able to do everything."

While BIUST draws attention and largess, Botswana's older engineering school has embarked on its own spending spree. For 18 years, students and faculty had been stuck on a campus designed for vocational courses in the 1970s, with professors squeezed into prefab, mobile-home offices. This year, they all moved into a complex of new, three-story red brick buildings. Overall space for labs, offices, classrooms, and libraries has doubled. "Those University of Botswana engineers, they are big spenders," says the government's Maedza.

Asked to compare the $28 million, state-of-the-art facility with the sheds previously used for labs, Chuma could only laugh. "They're simply not comparable," he explains. Still, many professors worry that they will be moving into the new space before sufficient equipment has arrived. Mechanical engineer Edward Dintwa predicts it will take a number of years to reach the point where "the labs are adequate." Nevertheless, the high-tech machinery that has trickled in represents a huge leap forward. Nkwae is particularly enthused by the ATS Lever Arm Creep Test System being installed in the new civil engineering lab. "I don't think even the University of Cape Town has one of those," he brags.

Two large labs in the facility have been set aside for what will soon be the Department of Mining Engineering. Chuma admits that mining "got forgotten" as the university was expanding its engineering programs. This is partly because successful local mining companies – Botswana is the world's largest producer of diamonds – paid for the overseas scholarships. A close relationship developed with Missouri S&T, and a "3 + 2" system was established. Students spend three years at UB studying fundamentals of engineering, math, and science, and then specialize in mining courses in Missouri for their junior and senior years. Currently, more than 20 UB students are completing degrees in the Show-Me State.



The former British protectorate has enjoyed more than four decades of stable civilian government, progressive social policies, and significant investment, creating one of the strongest, most stable economies in Africa. The country also has one of the world's highest known rates of HIV/AIDS infection.

Independence from Great Britain: 1966
Population: 2,127,825 (July 2013 est.)
Area: 361,470 square miles (slightly smaller than Texas)
GDP per capita: $17,100 (2012 est.)
Industries: Diamonds, copper, nickel, salt, livestock processing, textiles
Literacy: 85.1%
Languages: Setswana 78.2%, Kalanga 7.9%, Sekgalagadi 2.8%, English (official) 2.1%, other 8.6%
Ethnic makeup: Tswana (or Setswana) 79%, Kalanga 11%, Basarwa 3%, other, including Kgalagadi and white 7%

Source: CIA World Factbook

HOME FIELD ADVANTAGE

UB is counting on Moagabo Mathiba to bring them home. A lecturer in mining engineering, he has the task of setting up a full-fledged department so that mining engineers can complete their studies at UB. With degrees from the Technical University of Nova Scotia, Colorado School of Mines, and Missouri S&T, Mathiba believes that he and his colleagues are up to the challenge. "The people we have are all educated in North America," he says. "What more do we need?" Missouri S&T Mining Engineering Chair Frimpong says that his department in Rolla, Mo., will assist in developing curriculum and advising on the equipping of the University of Botswana laboratories during the transition years. Missouri S&T also has signed a memorandum of understanding with BIUST. That relationship is much newer, but, says Frimpong, "they want to develop their program fast."

Mathiba believes that locally trained talent will suit indigenous employers much better than experts educated overseas. He notes that the mines he monitored as a Botswana government inspector were more sophisticated than many he's seen in North America. "I tell my students: 'We have to do it here. Mining is running this country, so walk with your chest out and be proud.' "

Maedza hears from engineering graduates that Botswana companies will hire UB alumni ahead of those who studied abroad; he suspects that companies may trust those who are more familiar with local conditions, having interned within Botswana's borders. "There's always an advantage to learning mining engineering in the place where you are going to practice it," observes Frimpong, who hails from Ghana.

Mathiba did learn something overseas that he could not have learned at home, however. Observing the behavior of Canadians and Americans, he realized that back in Botswana, "we don't instill a lot of confidence in our kids, the way we bring them up." He believes that universities need to play a role in changing this mind-set, because it limits what an engineer can accomplish. "An American kid can do anything. Even if he can't, he'll do it because he believes in himself," notes Mathiba. "Ours can do it, but they don't believe they can."

UB's engineering and technology faculty is taking a major step to instill greater confidence in the quality of its program among students, employers, and the wider world by seeking global accreditation. Currently, no school of engineering in sub-Saharan Africa – outside of South Africa – is accredited by a signatory of the Washington Accord. UB has begun that arduous effort with the Engineering Council of South Africa. "The world is a global village now, and an engineer in Botswana should be the same as an engineer you get anywhere," explains Chuma. Already the engineering curriculum has been reformed to meet the strict criteria. And despite the process being "a hell of a job" that few were prepared to undertake, the engineering dean has submitted documentation to the council and expects provisional accreditation later this year. BIUST, as well, has tried to align its curriculum to meet the council's requirements and plans to seek accreditation when the university is more fully operational.

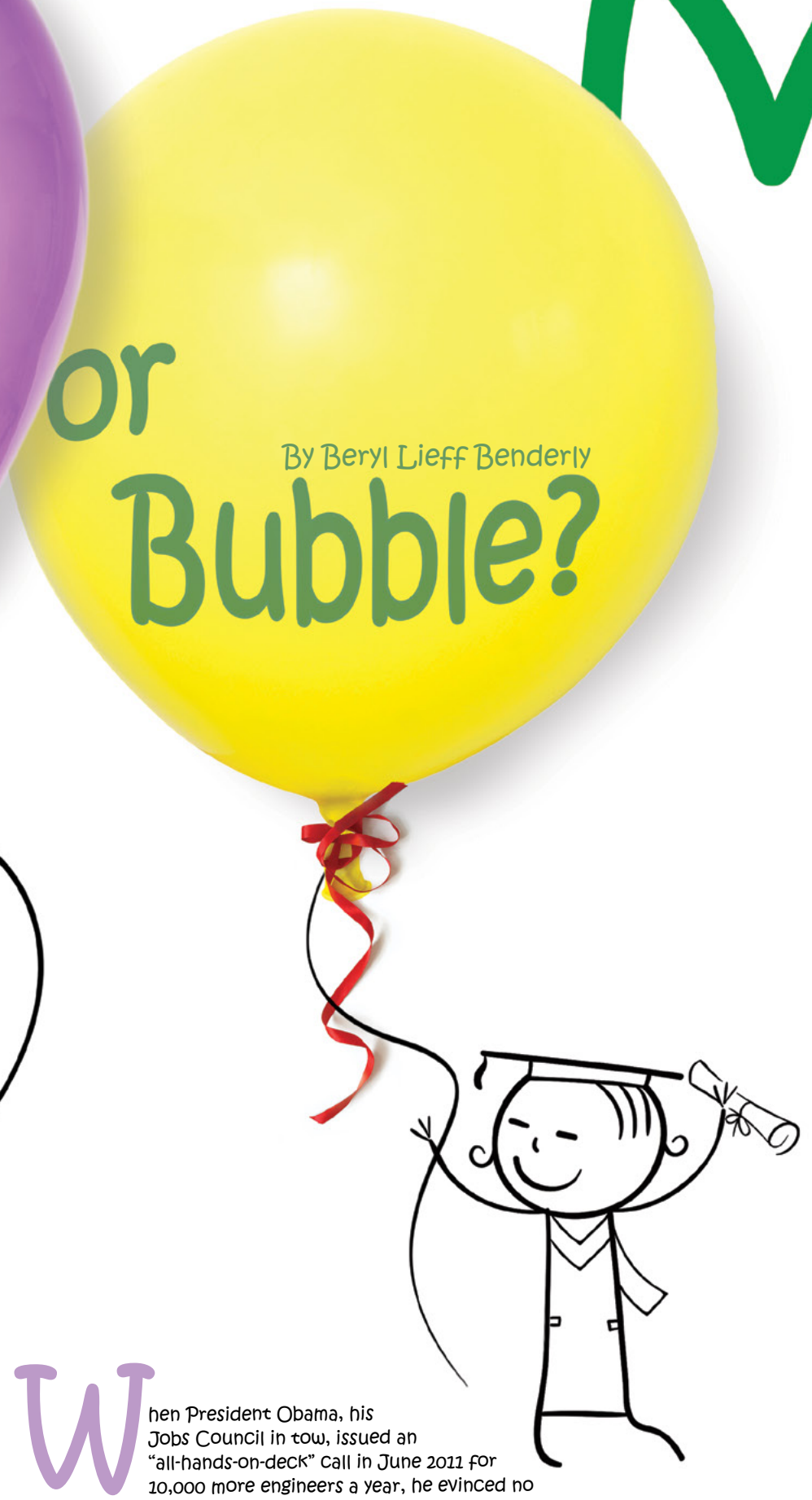
Of course, such accreditation potentially hands Botswana's engineering graduates a ticket for foreign jobs. But Chuma dismisses prospects of a brain drain. "We want the student who comes out of our institution to be the best," he says. "If we help the world by giving them a better product, so be it." So far, Botswana engineers seem content to stay put, enjoying a close-knit society in a peaceful nation with a growing economy. "I don't remember anybody sent [abroad] for a Ph.D. who didn't come back," marvels Chuma. "A lot of us got offers, but home is home."

Don Boroughs is a freelance writer based in South Africa.

Boom or Bubble?

Engineering schools wager that the job market will keep pace with swelling enrollments. Some economists aren't so sure.

By Beryl Lieff Benderly



When President Obama, his Jobs Council in tow, issued an "all-hands-on-deck" call in June 2011 for 10,000 more engineers a year, he evinced no doubt that good careers awaited the graduates. "The businesses represented here tell me they're having a hard time finding high-skilled workers to fill their job openings," he declared at Cree Inc., a growing LED technology manufacturer in North Carolina's Research Triangle. Six months later, he sounded puzzled when a young mother in Fort Worth told him during an online town hall that her husband, an experienced, patent-holding semiconductor engineer, was still looking for work three years after Texas Instruments laid him off. "The word we're getting," he told Jennifer Wedel, "is that somebody in that kind of high-tech field . . . should be able to find something right away."

Obama's seeming certainty about "a huge demand for engineers" is being put to a high-stakes test as a number of engineering schools across the country add buildings, programs, faculty, and students. To name just a few, the College of Engineering at Texas A&M, aims to boost enrollment from the current 11,000 to 25,000 by 2025; Purdue University's College of Engineering intends to expand its faculty by 100; and the University of Tennessee, Knoxville, its enrollment up by 37 percent in five years, plans to add more than 20 faculty.

But some labor-market economists urge caution, adding their voices to a long-running debate about the country's capacity to absorb many more scientists and engineers. These experts say the purported demand is not supported by wage data, varies markedly among disciplines and regions, and is vulnerable to economic cycles and marketplace trends. And they argue that simply graduating more engineers will not, in itself, stimulate innovation and development of the transformative technologies and successful new products that keep America competitive.

Prominent among these skeptics is Rutgers University public policy professor Hal Salzman, who has extensively researched the engineering labor market. In an April 2013 paper released by the labor-backed Economic Policy Institute in Washington, D.C., he and coauthors Daniel Kuehn and

Nicola Nittoli

B. Lindsay Lowell point out that U.S. colleges have historically produced about 50 percent more graduates than are hired into engineering jobs each year. Except in a few relatively small specialties, Salzman argues, demand for larger numbers of engineers does not exist. A notable exception is petroleum engineering, which in the past few years has experienced dramatic spikes in job openings, salaries, and numbers of students enrolled and graduating. In a typical year, Salzman says, "about 60 to 70 percent of engineering graduates get an engineering job," a figure that fell to 52 percent in 2009, following the economic collapse.

The Bureau of Labor Statistics projects that the entire science and engineering workforce will have added 1.1 million jobs between 2010 and 2020 as the economy, overall, adds 20.5 million new jobs. An additional 1.3 million scientists and engineers will be needed to replace those who are expected to exit S&E occupations during this period due to retirement, death, or career change. Thus the bureau projects a total of 2.4 million job openings in S&E occupations, 4.4 percent of the nationwide total of 54.8 million.

Labor shortages in particular occupations tend to cause a rise in wages. Yet over the past 30 years, wages for engineers and engineering technicians grew at a much slower pace – 18 percent – "than all other STEM occupations—and even slower than non-STEM occupations," reports a 2011 study by Georgetown University's Center on Education and the Workforce. Authors of that study explain the slow growth by pointing out that "in the beginning of the 1980s they had higher salaries than any other category of STEM worker." In contrast, however, workers in the "professional and managerial" category saw their salaries climb by 54 percent over the period; healthcare professionals' wages rose by 53 percent.

Cycles of Change

Further grounds for doubt about a constantly increasing demand for engineers appear in a March 2013 paper published by the National Bureau of Economic Research. A "great reversal" in the U.S. market for technical workers occurred around 2000, observe University of British Columbia economists Paul Beaudry and David Green, and Benjamin Sand of York University, all in Canada. The reversal, which resulted in markedly softened demand, is a predictable stage in a natural evolution of labor markets that often accompanies epoch-making technological change, such as the spread of computer-based information technology that began in the 1980s, they argue.

"Skill-based technological change can cause a boom and bust in the demand" for technically skilled workers, they write. The early phase of the shift, when the new technology is gaining ground against older methods, creates "high and growing demand for cognitive tasks to build the new" system, a phase that coincided with the tech boom of the 1990s. Once the new technology is widely disseminated and well established, however, skilled workers are no longer needed in such large numbers to create entirely new infrastructure and methods. Instead, they are needed in smaller numbers only to maintain the newly established system. Once this "maturity stage" arrives, which the authors say happened about the turn of the millennium, the former high demand for technological skills begins to fall off.

In the first decade of the 2000s, artificial prosperity fueled by the housing boom masked the onset of the "maturity" phase of the current technological cycle, they write. Once the bubble burst in 2008, demand for highly skilled workers turned sluggish. A nation that had grown accustomed to ever increasing opportunities for technically trained workers during the 1980s and 1990s erroneously interpreted that era's dynamic labor market as the cause rather than an effect of technological change. But today, the authors write, "even as the supply of high education workers continues to grow," the post-reversal, low-demand "maturity" period slogs on.

Manufacturing and construction employ about 50 to 60 percent of all engineers, Salzman notes. In addition to private companies, government is a significant employer of engineering talent, especially of civil, environmental, and structural engineers involved in building and maintaining public infrastructure and improving and inspecting private construction. Others, including a wide range of aeronautical, electronic, and other engineers, work either as government employees or contractors on often highly specialized defense, space, communication, and intelligence and other projects. Large numbers of engineering graduates also hold jobs not designated as engineering per se, especially as managers in a wide range of companies and organizations.

Given the work engineers do, most of their employment opportunities are "heavily dependent" on the economic or budgetary health of particular industries and government agencies, Salzman notes. In recent years, major sectors that employ large numbers of engineers – construction, manufacturing, and government — have been anything but robust.

Job Duration Varies

The structure of demand within specific industries influences more than the availability of jobs. The "dynamics of product cycles" also shape the careers of the engineers who work on them, says Stan Sorscher, labor representative for the Society for Professional Engineering Employees in Aerospace. Contrasting how long it takes to design and create products, plus how long they are supposed to last, in three industries that depend heavily on engineers – information technology (IT), biotech, and aerospace – he explains that "the IT product cycle is 18 months. For biotech it's probably four or five years, and for us in aerospace the product cycle is 20, 25, or 30 years" because purchasers of fighter jets, airliners, or the space station expect to "use that product for 15 or 20 years...or in the case of the B-52 [bomber],70 years."

Because of this, says Sorscher,"the value of judgment and experience is higher in some industries than it is in others, and the market discipline that you're going to face from failure is different in some industries. Some industries are very forgiving of failure, and some industries punish you very severely." Buyers of inexpensive electronics expect quick obsolescence and will tolerate imperfections, he notes. As the Boeing corporation's recent experience with defective batteries in its 787 Dreamliner aircraft shows, however, errors can have dire consequences in a product that takes years to design, costs millions of dollars, faces stringent safety and performance standards, and must perform reliably for decades. That is why in such industries "there's a competitive advantage to cultivating knowledge, skills, and experience over a long period of time...retaining them," and therefore to keeping effective employees for many years, Sorscher says. In biotech, where standards of performance and safety are exacting and the route to market can take "four to five years, the specific knowledge is very specific," he continues. "When you look at the employment dynamics of scientists and engineers in biotech, there's a certain amount of labor mobility, but not that much."

By contrast, in the "Silicon Valley model," based on the short life and relatively easy replacement of IT products, "the competitive advantage is [on] how fast you move and how marketable you can be rather than the specific skills that you've acquired," Sorscher says. Projects are short, movement among jobs is frequent, and employers therefore tend to favor young people rather than more senior engineers like Jennifer Wedel's husband, Darin. The bulk of the supposed difficulty hiring qualified engineers that employers and politicians cite occurs in this sector. Companies using this model, says human resources expert Peter Cappelli at the University of Pennsylvania's Wharton School, want to hire — not train — people with exactly the knowledge needed for their current short-term project, then lay them off when the project ends.

The plight of engineers like Wedel, who finally found a job as a quality engineer in the pharmaceutical industry six months after his wife's videotaped encounter with the president, worries Mark Thies, a Clemson University chemical and biomolecular engineering professor who is witnessing the "biggest enrollments in my 28 years" of teaching there. Thies points to a "very talented" computer engineer in his 50s who "did some real cutting-edge things a few years ago," but who has been "having a heck of a time" finding work after a layoff. He also mentions a very able mechanical engineer in her 40s who lost a $100,000 job "helping build airports and hospitals and things like that" in the 2008 economic crash, when her company's business went through a two-year collapse. As with Darin Wedel, family reasons kept her from relocating. Eventually she "had to take a job for $30,000 a year . . . a safety engineering kind of job."

Offshoring of both work and facilities has taken a toll in many engineering fields, Thies adds, although the impact varies by industry and, therefore, by engineering discipline. "It's hard to move a chemical plant," he says, "but what they'll do is build the new plants overseas." A "nontrivial" number of his former students have taken overseas assignments.

What are promising industries for today's engineering graduates? Certainly, energy is one – everything from petroleum extraction and solar and wind power to grid modernization and carbon capture, use, and sequestration (CCUS). A 2013 National Research Council study of the energy workforce, subtitled "A Call to Action," concluded: "The present and future are bright for those in or seeking energy and mining jobs. . . . Strong international demand for energy and mineral resources and the workers to provide them also will keep the market for qualified domestic workers robust" – and high paying.

Engineers and Innovation

These jobs depend in part, however, on government energy policies that can shift with political forces – pipelines and offshore drilling being just two examples – and on continued innovation in areas such as renewable fuels and CCUS. Indeed, the new petroleum abundance itself results from fracking advances. President Obama cited the key role of engineers in innovation in February 2012 when he lauded deans at the White House for their commitment to producing more engineers. However, relatively few engineers – Salzman says under 10 percent – are actually involved in innovation, specifically in creating new products. Small numbers of engineers are also involved in "process" innovation, mostly improving existing production methods, Salzman adds. "I don't want in any way to undervalue process innovation," which can be very significant, he says, "but most of it is not the kind of innovation that gets noted" in statistics. Salzman argues – and President Obama presumably would not disagree – that to stimulate innovation, the country must invest more in research and discovery. "Having a good supply of engineers, that's not what drives innovation," Salzman says. "Are firms investing in R&D? Are they hiring? Creating engineers without jobs is not what leads to innovation." Instead, "if you want innovation, put money into innovation."

Beryl Lieff Benderly is a Washington writer and a fellow of the American Association for the Advancement of Science.

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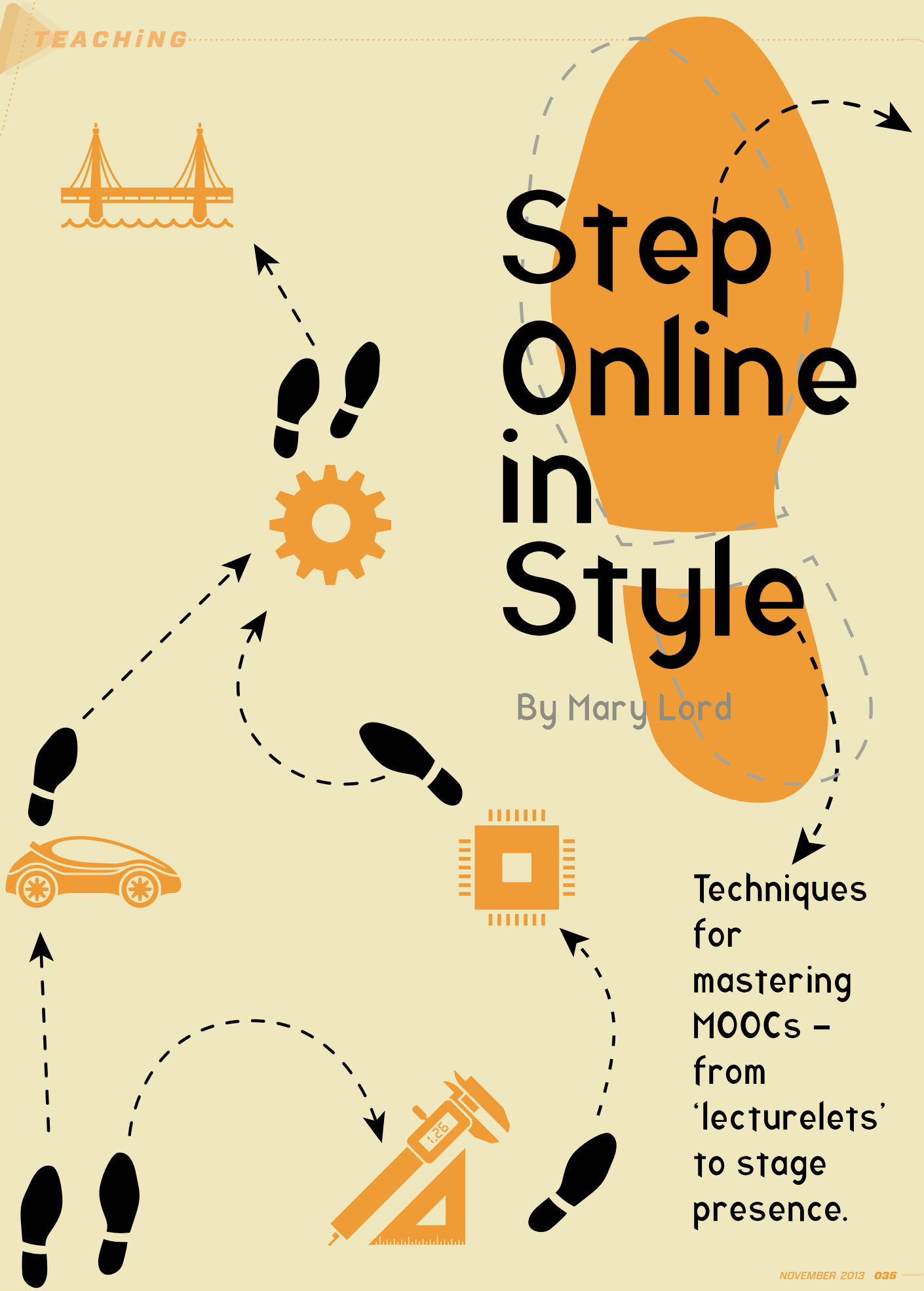


Step Online in Style

By Mary Lord

Techniques for mastering MOOCs – from 'lecturelets' to stage presence.

What would prompt a tenured faculty member to stare into the camera's unblinking lens and teach a course that requires prodigious amounts of preparation, yet conveys no credit or extra pay?

For John Owens, an associate professor of electrical and computer engineering at the University of California, Davis, it was the "phenomenal" opportunity to reach thousands of students and help shape the future of education rather than have to comply with some top-down directive later. Altruism, specifically a "corny" desire to expand access to learning and "maybe excite high school students" about engineering, spurred Georgia Tech mechanical engineer Wayne Whiteman's studio debut. Whatever the reason, the rapid rise of massive open online courses – Coursera alone claims 5 million students worldwide – means there may be a MOOC in your future.

MOOCs are "a very different experience than teaching in a classroom," cautions Owens, who became the first MOOC maker on campus with the launch of Introduction to Parallel Programming on Udacity in February. In a real classroom, instructors can see if students look puzzled and come up with different examples or explanations on the fly. Not so with a one-way MOOC broadcast. Also, "you can't just take your lecture notes for class and read them on camera," advises Whiteman, whose five-week Introduction to Engineering Mechanics debuted on Coursera last spring.

The rewards – from institutional, departmental, or personal prestige to improved pedagogy and learning outcomes – seem worth the effort, however. These tips from the MOOC masters should help engineering educators step online in style.

Keep it short

Think of MOOCs as educational TV for channel surfers: Attention and attendance wane quickly. "Signing up is really a low bar," notes Georgia Tech's Whiteman, whose first online offering attracted 17,000 registrants, with 2,000 sticking through all five quizzes and 1,500 earning a statement of accomplishment. While that's still "more students than I've touched in my statics courses in my entire 30-year career," he says, falloff is significant. Moreover, MOOCs attract a wide spectrum of ages and experiences. Whiteman's, for example, enrolled students as young as 10 along with 4.5 percent who were academics or had Ph.D.'s.

To captivate such a diverse audience, "it's good to have bite-sized content," advises Whiteman, who has distilled basic mechanics into short modules and "edu-bytes" of no more than 10 minutes. Armando Fox, professor in residence in electrical engineering and computer science at the University of California, Berkeley, reorganized his 90-minute lecture into 8-to-12-minute video segments or "lecturelets" for his software engineering MOOC, each covering a topic with one or two self-check questions. Evidence from the field suggests shorter is sweeter. New data from edX, a nonprofit MOOC provider created by MIT and Harvard, for instance, put the optimal length for lecturelets at 6 to 9 minutes. Median viewing time, where half the students watch the entire clip, peaks at 6 minutes, then falls rapidly. The edX data also reveal that mixing talking heads with computer screenshots or slides is more engaging than screenshots with voice- overs.

Plan every move

MOOCs require "a huge amount of work," says UC Davis' Owens, who devotes two full days preparing each 60- to 90-minute lecture. To maximize his instruction time, he writes eight pages covering not only exactly what he will say, including jokes, but what he will draw. It takes eight hours to record the lecture, stopping, starting, and rewriting as necessary. The editing crew needs 32 hours to synchronize the audio, screencasts, and video into a complete lecture. Online education veteran Autar Kaw, a mechanical engineering professor at the University of South Florida, estimates that it takes five to 10 hours to produce each hourlong lecture video beyond the time needed to develop textbooks, simulations, and real-world problems.

"It can be overwhelming," agrees Georgia Tech's Whiteman. "Focus on clear, precise delivery of basic concepts," he recommends, but "don't dumb down the material." His course isn't "statics for dummies."

Production values count

"Do not do it all by yourself," says Kaw. "That is a simple recipe to give up making a MOOC." Get all the technical help you can, and let others produce the videos and type the textbook. Even without glitzy graphics, online courses require high-quality sound studios, video editors, and programmers. Lighting must be adjusted and microphone wires hidden. "This would be impossible to do on my own to this level of quality," says Whiteman, who goes through dry runs before taping several modules at a stretch in the campus studio. To simulate the classroom experience, he reviews the script with the tech crew, noting where the lug wrench, cherry-picker truck, or other physical example will sit on his desk and when he will refer to them. He also meets twice a week with a graduate teaching assistant to review all materials before uploading them at the beginning of each week. Still, he admits, "it's really weird at first to talk to the camera and no students are around."

While few MOOC stars undergo media training or use TV makeup – "It would not have done any good anyway!" jokes Autar Kaw – most develop stage techniques that improve engagement and streamline production. Kaw practices "like crazy." He makes sure to wear dark solids and ties that are light orange, green, or blue. "Avoid stripes and very shiny clothes at all costs," he warns. John Owens tapes a sticky note that exhorts "Energy" above the camera to keep him as animated on screen as he is in class. "You really have to crank it up," he says, noting that his online students mostly see his hand sketching "crummy" drawings while he talks. "As far as the students in the class know, I could be a robot above the elbow," he joked on his blog.

Illustration by Nicola Nittoli

Mix it up with students

Although they lack the give-and-take of live classrooms, MOOCs can engage students. Whiteman, for example, includes as many visual examples as possible to explain concepts, from brandishing a lug wrench to displaying a 3-D model of the x, y, and z axis along with the mathematics of calculating force equilibrium. He pauses every few minutes to have students reflect on a question, starting in Module 1 by asking them to jot down the difference between engineers and scientists. (His answer, drawn from aeronautical engineer Theodore von Kármán: The scientist describes what is, the engineer creates what never was.)

Autar Kaw recommends presenting materials in different forms and letting students express themselves in multiple ways. "I know students are engaged when they ask me questions via YouTube and email." Owens promotes interactivity by joining his students' "lively" online discussions, posting hundreds of comments. An experienced MOOC instructor advised him to wait an hour before jumping in when a student posts a question. Chances are another student will have provided the answer, freeing Owens to respond to the hardest, most interesting questions.

Amy Schmitz Weiss, an associate professor of journalism at San Diego State University who co-taught a MOOC on data-driven reporting, urges instructors to state up front how quickly they will respond to inquiries; send a welcome message at the beginning and end of each week; and provide multiple ways to participate, including using social media; and consider holding virtual live chats. Above all, she says, review forum postings, and participate in the discussions.

Occasionally, "vocal jerks" hiding behind fake email addresses can wax rude and crude in the discussion threads. "Don't let their behavior get you down," stresses Armando Fox, "and don't let it sour the experience for the vast majority of students."

Recruit student TAs

Fox, who has co-taught software engineering courses on Coursera and edX, notes that the "cross-cultural, cross-time-zone reach of MOOCs obliterates" the normal rhythms of sleep, exams, and holidays, making it hard for professors to check forums and post frequently. Moreover, MOOCs don't have formal office hours. To keep abreast of traffic and help students enrolled in his first MOOC offering, Fox had undergraduates who had done well in the on-campus course monitor online forums. Subsequently, he recruited "World TAs" from the highest-scoring MOOC students and deputized an undergraduate to serve as head TA and organize them using a Google Group mailing list. Result: Nearly 24/7 global coverage by multilingual students, "and we get to have a life," reports Fox.

Embrace online assessments

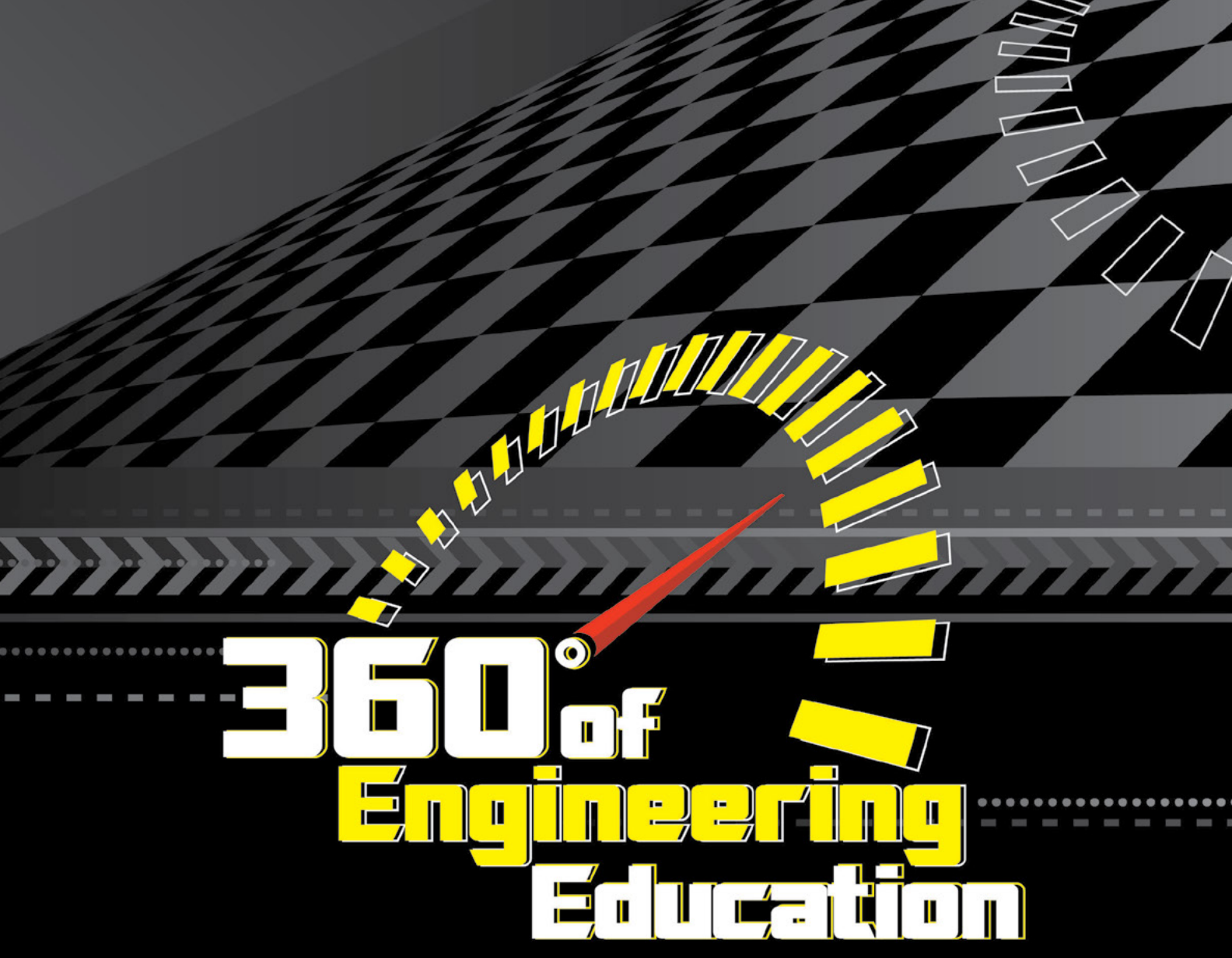
Though "not fond" of multiple-choice tests, Whiteman finds "they work well in the MOOC environment." Besides, he adds, "there's no way I could grade 4,000 exams!" Beyond generating "tons of data," online quizzes are graded automatically, providing rapid feedback to students and instructors. An uproar ensued, for instance, after students discovered a wrong answer in Whiteman's first quiz. He quickly regraded and gave credit, but "it was high adventure for a few hours." Some MOOCs have a peer-grading option, but the system seems impractical when capabilities range from elementary to graduate students.

Cheating remains a concern, since instructors have no way to know if the person taking a quiz is copying answers or is even the genuine registrant. However, MOOC providers are developing signature-tracking certification and other methods to verify identity. Online proctoring services also are springing up. In addition, the barriers to hands-on labs are falling with the incorporation of smartphones and other technology.

So far, many MOOC pioneers find their investment yields dividends for their on-campus students. "It's another resource," says Whiteman, who has had undergraduates taking a Georgia Tech statics course and using his MOOC at the same time. Autograding frees up TAs to spend more quality time for Fox's on-campus students, while breaking classroom lectures into short lecturelets has made them "livelier and better-attended." Fox reports that ratings for both his teaching and the on-campus course went up when MOOC technology was integrated.

After more than a decade of online teaching, USF's Kaw still prefers the "social experience" of the traditional classroom but says it's like choosing between going to the movies and watching Netflix: "I like both." MOOCs clearly are shaking up the status quo, promising to transform engineering teaching and learning. Says Georgia Tech's Whiteman: "Like it or not, the train is moving, so you might as well get on it and be part of where it's going."

Mary Lord is deputy editor of Prism.



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Beyond Hands-On

Some active-learning methods are more effective than others.

BY MUHSIN MENEKSE, GLENDA S. STUMP, STEPHEN KRAUSE, AND MICHELENE T. H. CHI

The relationship between instructional methods and student learning has been a central research topic in higher education for decades. Though many studies have shown that student-centered active learning methods are more effective than traditional lectures in helping students understand complex science and engineering topics, some studies have found no difference or even an opposite effect. These discrepancies can be explained by the variability in scope of active-learning methods; generally the term "active learning" is used for a wide variety of classroom activities. However, treating all classroom activities as engaging students in the same way ignores the specific cognitive processes associated with each type of activity. Without a comprehensive framework to classify active-learning methods, it is difficult to compare their value. Consequently, educators and administrators may underestimate the potential benefits of different active-learning methods.

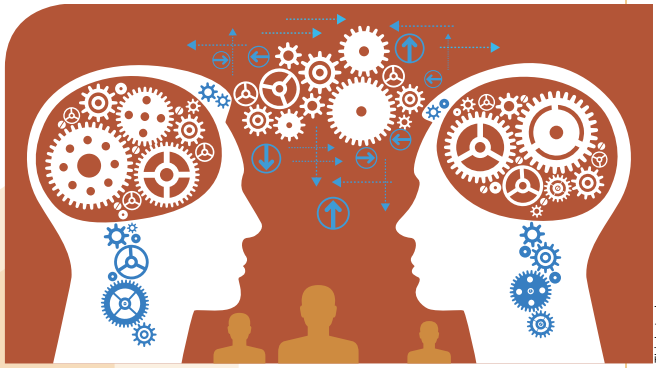
To address the lack of such a framework, Michelene T. H. Chi (2009) proposed the Differentiated Overt Learning Activities (DOLA) framework, which divides active-learning methods into three modes — active, constructive, or interactive — depending on the students' overt engagement in them. Activities designed as active should involve learners in hands-on manipulation of learning materials. Constructive activities are expected to facilitate the generation of new ideas beyond those directly presented, while interactive activities typically should generate ideas that build on each other, but only when all students contribute substantial intellectual effort in collaborative settings.

Based on the hypothesized cognitive processes corresponding to each mode of activity, Chi reviewed and reinterpreted experimental studies in the learning sciences literature. She hypothesized that interactive activities are generally more effective than constructive activities, which in turn are better than active activities. All three modes are better than passive methods in promoting students' learning. Chi called this relationship the Interactive > Constructive > Active > Passive (ICAP) hypothesis.

In our study, we tested the ICAP hypothesis in an engineering context. We collected data from an actual classroom setting and from a controlled experiment to compare students' knowledge and conceptual understanding of materials science and engineering concepts after they completed learning activities using each mode of active learning.

Results from the classroom provided support for the ICAP hypothesis when the DOLA framework was used to structure learning activities. The positive results held despite such confounding factors as differences in the level of student participation in the interactive activities and differences in time on task during the learning activities. By comparing all active-learning modes in a controlled environment, we reduced these confounds significantly. The results provided strong support for the part of the ICAP hypothesis that posits that interactive activities enhance learning better than constructive activities. Our results showed that when students engaged in joint dialogue and constructed knowledge collaboratively, they not only generated knowledge on their own but further benefited from their partners' feedback and contributions. Constructive activities enhance learning better than active activities because they allow students to generate new knowledge and revise misunderstandings. Finally, active activities are more effective than passive ones; manipulating the learning materials allows students to activate relevant knowledge and assimilate new information to fill knowledge gaps. Passive activities may store new information only infrequently.

A thorough understanding of core concepts in materials science and engineering provides a significant intellectual challenge for students. They must comprehend the relationships between the macroscale properties of materials and their nano-, micro-, or macroscale structures, and undertake complex cognitive processes such as decision making, spatial reasoning, knowledge construction, and integration. Our results show that DOLA can guide the design of learning materials and activities that promote development of these higher-order skills.



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Muhsin Menekse is a research scientist at the University of Pittsburgh's Learning Research and Development Center. Glenda S. Stump is an associate director at the Massachusetts Institute of Technology Teaching and Learning Laboratory. Stephen Krause is a professor of materials science and engineering at Arizona State University, where Michelene T. H. Chi is a professor of psychology and director of the Learning Sciences Institute. *Adapted from "Differentiated Overt Learning Activities for Effective Instruction in Engineering Classrooms" in the July 2013* Journal of Engineering Education. *Supported by NSF grant 0935235 and Institute of Education Sciences grant 943360412.*

Education Superpowers

How Finland, South Korea, and Poland produce high achievers.

The Smartest Kids in the World and How They Got That Way
by Amanda Ripley, Simon & Schuster 2013, 306 pages

Rigor. The word appears more than 80 times in Amanda Ripley's new book, offering a key reason why American education is faltering: lack of rigor in classrooms, textbooks, curricula, teacher preparation, and even "conversations at home around the dining room table."

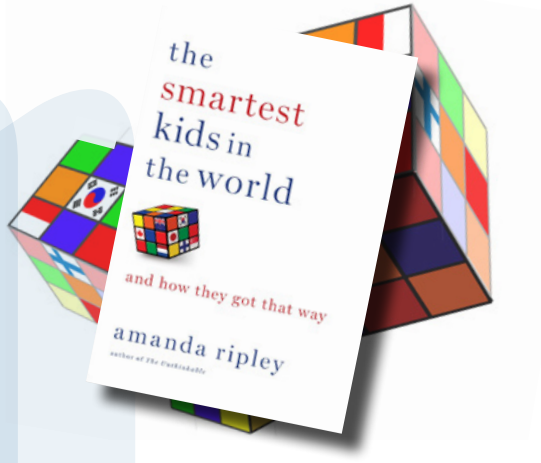
A lackluster and uneven educational system is nothing new to this country. The United States has long ranked as "typical, not much better nor much worse" than most nations when it comes to international student comparisons, particularly in math and critical thinking skills. Yet while a strong economy and high standard of living once cushioned the need for a highly educated populace – "wealth had made rigor unnecessary in the United States" writes Ripley – that situation is changing rapidly. Even as the world gears up for a fast-paced, technological, and globally connected workforce, American high school graduation rates are declining, while university freshmen and graduates alike lack requisite skills for college courses and first-time jobs.

Like others trying to make sense of the country's education dilemma, Ripley, an investigative reporter, turns to nations that achieve much stronger results. Her approach, however, moves beyond testing and political rhetoric to the students themselves. *The Smartest Kids in the World* follows three American high schoolers as each spends a year of study abroad in Finland, South Korea, and Poland – three education supernations. Ripley's "field agents" help her explore ground-level aspects of student life, from Koreans snoozing at their desks to Finnish "stoner kids" diligently taking notes in class. Some of her findings confirm what we've heard, that even Finnish rebels value their education, for example. Others are more surprising. Eric from Minnesota discovers that his Korean peers sleep during the school day because real study takes place at private nighttime academies known as *hagwons*, with the single goal of acing the national graduation exam. Performance on this exit test determines who joins the mere 2 percent to place into Korea's three top universities, ensuring them the best jobs and top social status. Korea's international test results may be laudable, but behind the country's stellar achievement is a troubled "Iron Child" culture, which even the minister of education decries. Nonetheless, this "hamster wheel" system produces young people able to grapple with complexity, persistence, and hard work. Unlike American youth, "they were prepared for the modern world," Ripley writes.

Finland and Poland emerge as countries with more balanced priorities and lessons to be studied. As we follow the adventures of Kim from Oklahoma, attentively cared for by her Finnish teachers, Ripley elucidates upon the intense training of instructors in this Scandinavian country, where acceptance into education programs is akin to that of top U.S. medical schools.

Less known, perhaps, are Poland's radical reforms over the past 15 years, from a revamped national curriculum to standardized tests, an additional year of high school, and incentives for teachers and schools. The new system catapulted the country from a year 2000 international test ranking of 21st in reading and 20th in math – below America and much of the developed world – to 13th in reading and 18th in math by 2003. By 2009, spending half as much per student as America, Poland outperformed it in both math and science. For Ripley, that success comes from rigor – a determination to push through reforms despite ongoing opposition.

When Ripley examines the schools of her three students at home in Oklahoma, Minnesota, and Pennsylvania, she finds everywhere an absence of rigor, from classrooms "tricked out" with sophisticated but ill-used equipment to parents far more invested in school sports than math instruction and lawmakers strenuously resisting comprehensive standards, likening tests to child abuse. Finland, Korea, and Poland are "complicated and unfinished" in their efforts, the author admits, but all three suggest ways to embrace a serious intellectual culture. Beyond another grim portrait of U.S. failure, this book animates the debate over K-12 education with lively directions for change. For engineering academics entering the fray, it provides a highly readable discussion undergirded with useful statistics and studies. The extensive bibliography, notes and appendix on "how to spot a world-class education" are all highly informative.



Robin Tatu is Prism*'s senior editorial consultant.*

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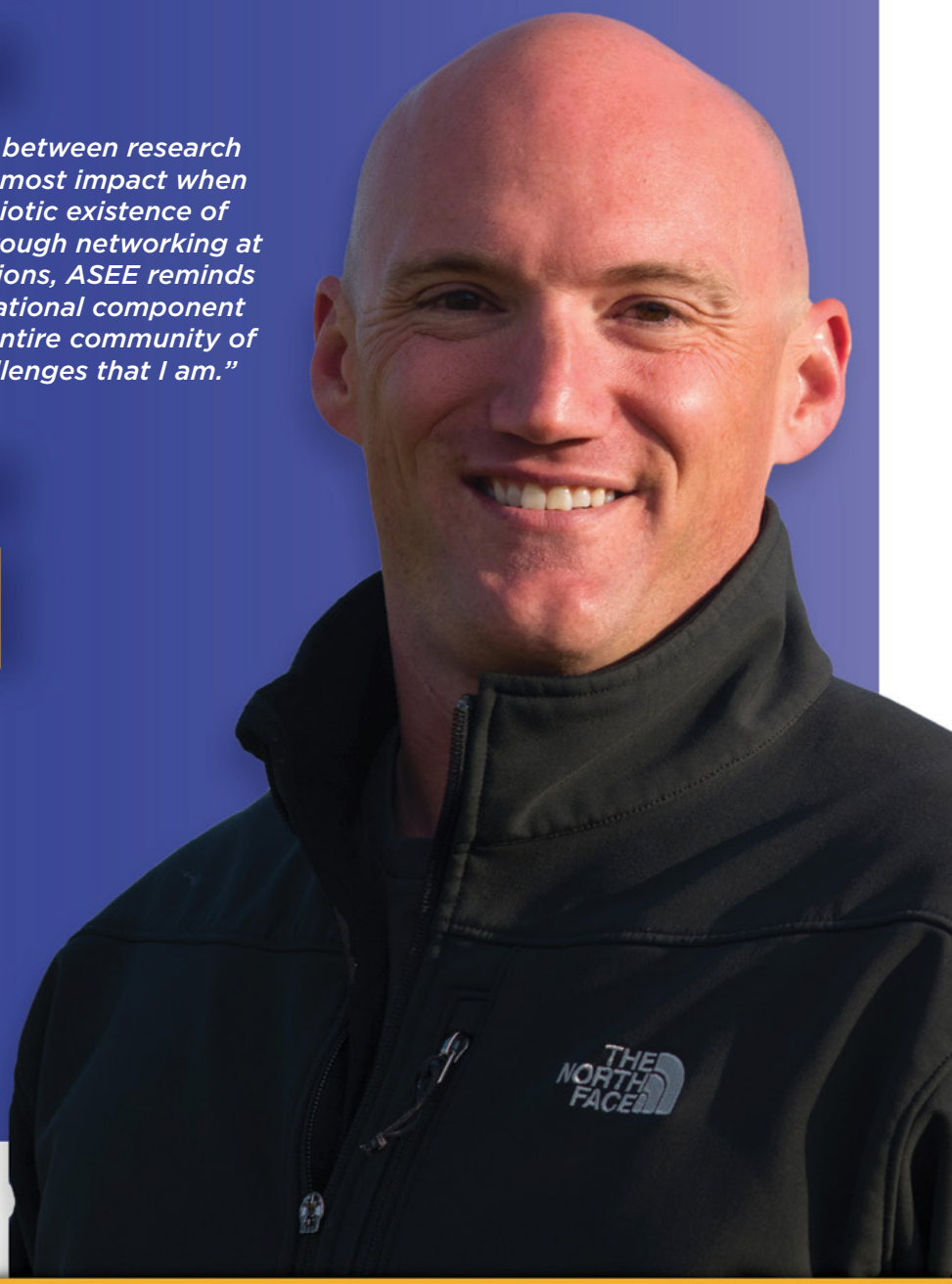

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NOMINATIONS FOR TWO THOUSAND FOURTEEN ASEE BOARD ELECTIONS

Presented on the following pages are candidates for offices to be voted on in the 2014 ASEE elections. These candidates were selected by the 2013 ASEE Nominating Committee, chaired by Don P. Giddens. The nominations were received by the executive director as required by the ASEE constitution. The ASEE Nominating Committee believes that the candidates offered here are eminently qualified and deserve the close consideration of the membership.

Members are reminded that additional nominations of eligible candidates may be made by petition of at least 200 individual members. Nominees so proposed must indicate a willingness to serve before their names are placed on the ballot. Such petitions and agreements must be presented to the executive director no later than January 1, 2014.

Write-in votes will be accepted for all offices. In all cases, a simple plurality constitutes election. The official ballot, which will be furnished to each individual member by March 1, must be returned by March 31.

Editor's note: Due to space limitations and in the interest of fairness to all candidates, the biographies and statements have been edited to fit the allotted space.

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Dean and Clay N. Hixson Chair for Engineering Leadership, College of Engineering
Tennessee Technological University

Joseph J. Rencis received his associate and bachelor's degrees in architectural and building construction engineering technology from Milwaukee School of Engineering (MSOE), a master's degree in civil engineering from Northwestern University, and a doctorate in civil engineering from Case Western Reserve University. He joined the mechanical engineering department at Worcester Polytechnic Institute (WPI) in 1985 as assistant professor. Over time, Rencis rose through the ranks to become a full professor and the director of engineering mechanics at WPI. In 2004, he joined the University of Arkansas, Fayetteville, as a professor, department head, and 21st Century Leadership Chair in Mechanical Engineering. Rencis joined Tennessee Technological University in 2011 as dean, Clay N. Hixson Chair for Engineering Leadership, and professor of mechanical engineering. He is an inaugural fellow of the Southeastern Conference Academic Consortium Leadership Development Program. Rencis has also served as chair and vice chair of the Mechanical Engineering Department Heads Committee of the American Society of Mechanical Engineers (ASME).

Throughout his career progression, Rencis has demonstrated a focus on engineering education. Since 1995, he has attended each ASEE Annual Conference and Exposition. Rencis has published 40 papers at ASEE national, zone, and section conferences. His career is documented in 35 journal papers and over 100 conference papers. National Science Foundation (NSF) educational grants include REU, CCLI, TUES, and GK-12. He has also carried out research in boundary elements, finite elements, and multi-scale modeling.

Rencis has been active in ASEE at the national, sectional, and institutional levels. He is currently chair of Professional Interest Council III, a member of the ASEE Board of Directors, and a member of the Deans Council Public Policy Committee. He served as chair of the Awards Policy Committee, a member of the National Outstanding Teaching Award Committee, chair and program chair of the Mechanics Division, chair and program chair of the Mechanical Engineering Division, chair of the Midwest Section, and campus representative. Rencis has served on numerous other ASEE committees. Some major service accomplishments include developing new awards, fundraising for awards and conferences, serving as division web master, and increasing membership. He also has led two ABET program evaluations at different institutions and served as an ABET program evaluator. Rencis is a registered professional engineer in Massachusetts and a fellow of both ASEE and ASME. ASEE awards and recognition include the Mechanics Division James L. Meriam Service Award, New England Section Outstanding Teaching Award, New England Section Outstanding Leader, Midwest Section Outstanding Service Award, and Midwest Section Outstanding Service in Program Sponsorship.

CANDIDATE'S STATEMENT

As an individual who is passionate about advancing engineering and

engineering technology education, I am extremely honored by the nomination to serve as ASEE president-elect. My major goal will be to increase student success by promoting the integration of transformative learning experiences into the curriculum.

Today, students naturally bring us diverse talents and abilities to be nurtured and allowed to develop. Throughout my career, I have experienced how transformative learning experiences can effectively broaden and deepen students' intellectual and world views. I define a transformative learning experience as an opportunity inside or outside the classroom that enriches student learning and personal development. One example is a co-op or internship, where students can make a life-changing transformation, going from an uncertain direction to taking control of their academic and career paths. Other examples of transformative learning experiences include society-technology projects, industrial projects, research experience, study abroad, service-learning, learning community, leadership experience, and independent study.

A stated priority of President Obama's Council on Jobs and Competitiveness is to address America's engineering shortage by graduating 10,000 more engineers from U.S. colleges and universities each year. Transformative learning experiences have been shown to increase retention and graduation rates. In the case of underrepresented groups, the impact on student success is more pronounced than in the general population. Student success can also be increased through the application of pedagogical practices regarding the way individuals learn inside and outside the classroom. This will enhance and personalize the faculty's connection to students.

My 29 years as a faculty member, university administrator, and volunteer for professional societies have provided me with opportunities to develop leadership skills to serve in this position. My cumulative experience as a contributing ASEE member has been valuable, rewarding, and enjoyable. With each leadership position, I have worked collaboratively with members and staff to advance the division/section to the next excellence level. I am committed to ASEE's mission and the pursuit of moving the society forward. It's my conviction that transformative learning experiences are the future of engineering and engineering technology education and that this can take ASEE to new heights.

I would be honored to serve as the next president-elect; and, on behalf of the membership, I will continue to advocate and promote the value of engineering and engineering technology both nationally and internationally.

ANN SATERBAK
Professor in the Practice and Associate Chair for Undergraduate Affairs Bioengineering Department
Rice University

Ann Saterbak is professor in the practice and associate chair for undergraduate affairs in the Bioengineering Department at Rice University, Houston. In her teaching, research, and administrative capacities at Rice, Saterbak is fully devoted to engineering education.

Saterbak joined the bioengineering department shortly after it formed and was responsible for developing its laboratory program. She was recognized for this achievement in 2007 with the ASEE Robert G. Quinn Award for Excellence in Laboratory Instruction. Saterbak introduced problem-based learning in the School of Engineering and more recently launched a successful first-year engineering design course. Saterbak is the lead author of the textbook, *Bioengineering Fundamentals*.

Saterbak's outstanding teaching has been recognized with university-wide and departmental teaching awards. In 2011, she was the sole recipient of the university's most distinguished teaching award. Because of her innovative teaching practices and her sustained mentoring of other engineering faculty, she was selected as one of 16 founding fellows in the Center for Teaching Excellence at Rice. In 2013, Saterbak received the ASEE Biomedical Engineering Division's Theo C. Pilkington Outstanding Educator Award. For her contribution to education within biomedical engineering, she was elected a fellow of the Biomedical Engineering Society.

Involved in ASEE since 2000, Saterbak served on the Board of Directors as PIC II Chair from 2009 to 2011. In that role, she supported active divisions, managed the transition of inactive divisions, and helped form a new constituent committee. She held many roles in the Biomedical Engineering Division, including Program Chair and Chair. She served on the ASEE Membership Policy Committee and the Awards Policy Committee. To date, she has presented 11 papers at national ASEE conferences.

Saterbak has received federal, nonprofit, and institutional grants to support engineering education. Her National Science Foundation grants have supported research and curricular development for biomedical engineering and first-year engineering education. Saterbak also mentored design teams who garnered substantial national accolades and funding for continuation of projects beyond the classroom.

Saterbak graduated summa cum laude in 1990 from Rice University with a bachelor's degree in chemical engineering and biochemistry. In 1995, she earned a doctorate in chemical engineering from the University of Illinois at Urbana-Champaign. Following a four-year position as an associate research engineer at Shell, she joined Rice in 1999. Weaving together her industrial background, leadership experience with ASEE, acclaim as a teacher, and experience as a classroom innovator, Ann Saterbak is qualified to lead ASEE as president-elect.

CANDIDATE'S STATEMENT

I am passionate about transforming undergraduate engineering education at U.S. colleges and universities. If selected as president-elect, I will work tirelessly with ASEE members and the teams of dedicated ASEE staff and volunteers to realize significant changes in engineering and engineering technology (E/ET) education.

As an organization, ASEE should increase and broaden its support for members' efforts to implement educational methods that have a significant impact on student learning and performance. As discussed in publications such as "Innovation with Impact: Creating a Culture for Scholarly and Systematic Innovation in Engineering Education," ASEE should be leading this transformation by supporting schools, departments, and individual faculty members to remove barriers to innovation, adopt research-driven pedagogies, and engage the broader STEM community. As your president-elect, I would develop three ideas to increase the impact of the organization:

1. Expand professional development in teaching, learning, and best practices for E/ET faculty. In addition to expanding strong existing programs, ASEE should create new delivery platforms for professional development to reach faculty on their campuses or at other professional meetings.

2. Increase ASEE's partnerships to support changes in the classroom and on campuses. Through dialogue and strategic partnerships with industry, government, and foundations, ASEE and its members can benefit from an infusion of new ideas and resources.

3. Reward more individuals, departments, and institutions for effective educational innovation. This can be accomplished by ASEE initiating greater recognition and monetary prizes for outstanding accomplishments.

As ASEE members, we should all be practicing proven innovations in E/ET education. As individuals, we should be agents of change in our own classrooms, laboratories, and workshops, as well as supporting peers and system-wide changes at our institutions. As president-elect, I would passionately support members on the front line of adopting pedagogies and methods that improve student learning.

Individuals and institutions rely on ASEE to support E/ET education. The organization must deliver high quality programs, publications, and resources that are valued by its members. The annual and section conferences should be rich with classroom teaching ideas and opportunities to network with supportive colleagues. As president-elect, I would focus on enhancing member services and increasing membership.

In conclusion, I am strongly committed to ASEE and its members as we work together to transform E/ET education. If elected, I will use my enthusiasm as a teacher and vision as a leader to engage in this critically important transformation. I appreciate your vote.

CANDIDATES FOR THE OFFICE OF VICE PRESIDENT, MEMBER AFFAIRS

B. GRANT CRAWFORD
Associate Professor, Director of the Mechanical Engineering Program
United States Military Academy

Grant Crawford is an associate professor and a colonel in the United States Army and the director of the Mechanical Engineering Program in the Department of Civil and Mechanical Engineering at the United States Military Academy. Now in his 13th year on the faculty at West Point, Crawford has taught courses in thermodynamics, fluid mechanics, heat transfer, fixed-wing aerodynamics, helicopter aeronautics, computer-aided design, mechanical engineering design, aerospace systems design, and military science. He also directs the mechanical engineering capstone design course.

Crawford was commissioned a second lieutenant in the United States Army upon graduation from the United States Military Academy with a B.S. in mechanical engineering in 1985. Following initial military assignments to Korea and Germany, he earned his M.S. in aerospace engineering from the Georgia Institute of Technology in 1994 and taught at West Point as an instructor and assistant professor. From 1998 to 2001 Crawford again served in an operational assignment with the Army until his selection to return to the West Point faculty as a

senior faculty member. He earned his Ph.D. in aerospace engineering from the University of Kansas in 2004 and returned to West Point as an assistant professor and director of the Aerodynamics and Thermodynamics Group. Crawford was promoted to associate professor in 2008 and assumed his current position as director of the mechanical engineering program. In this capacity he has taught numerous engineering education seminars both in the United States and in India. He served as a mentor to the engineering department faculty at the National Military Academy of Afghanistan in the summer of 2009.

Crawford has served ASEE in a variety of national-level positions and is currently the immediate past chair and secretary of Zone I. He is also serving as chair of the Fundamentals of Engineering Examination Committee of the National Council of Examiners for Engineering and Surveying (NCEES) and as a mechanical engineering program evaluator for the Engineering Accreditation Commission of ABET Inc. Crawford holds commercial pilot ratings in both fixed- and rotary-wing aircraft and has been a registered professional engineer in the commonwealth of Virginia since 1998. He is a past recipient of ASEE's Mid-Atlantic Section Teaching Award and the National Outstanding Teaching Award.

CANDIDATE'S STATEMENT

It is an honor to be nominated to serve as your representative for member affairs. This is an exciting time for ASEE with increased national focus on engineering and engineering technology education and STEM initiatives in our country and around the world. The vice president for member affairs will play a critical role in advancing ASEE's key initiatives, from our focus on student diversity and retention to STEM outreach and international engagement. I would like to be your representative on the team that leads these efforts.

This position requires a broad set of skills and abilities and requires communication with entities across the organization as well as those external to ASEE. ASEE has been my focal professional society. I have served as a campus representative and held numerous service and leadership roles at the section and zone level. In my roles as the Mid-Atlantic Section and Zone I chairs, my focus was on outreach to and communication with our members with the aim of serving their needs and effectively advocating for their priorities.

Working with teams predates my ASEE involvement. My service in the Army has taken me to a variety of places in the United States and around the world, from the Philippine Islands and Korea to Germany, Iraq, and Afghanistan. My service with ASEE and affiliated organizations has taken me across the United States and to India. In all instances, a major aspect of my responsibilities has involved listening to and working with people in a manner that reflects understanding and respect for the diversity of viewpoints and talents that we all possess. Each and every experience has served to hone my ability to team with a diverse range of people in pursuit of a common goal.

As vice president for member affairs, I will continue to build on the solid foundation laid by my predecessors. I will work on strengthening the connections with our membership so that ASEE can best serve your needs. I will work to build our membership base and increase the perceived relevance of ASEE to our external partners in education. I will work closely with our section leaders, PICs, and external partners to increase engineering and engineering technology student enrollments and increase industry, government and NGO engagement in this effort. I appreciate your consideration for this position and, if elected, will do my utmost to fulfill your trust and expectations.

DOUGLAS TOUGAW
Richardson Professor of Engineering
Valparaiso University

Doug Tougaw received a bachelor's degree from Rose-Hulman Institute of Technology and a master's degree and Ph.D. from the University of Notre Dame. He joined the engineering faculty at Valparaiso University in 1996 and currently holds the Richardson Professorship of Engineering. He received the Valparaiso University Alumni Association Distinguished Teaching Award in 2006, and he was named one of the 150 Most Influential People in Valparaiso University history in 2009. He served as department chair of electrical and computer engineering from 2001 to 2010 before returning to the classroom fulltime. A believer in lifelong learning, Tougaw earned an M.B.A. from Valparaiso University in 2004 and a Master of Higher Education Administration degree from North Park University in 2013.

Tougaw's research interests focus on nanotechnology and engineering pedagogy, and he has published more than 65 journal articles, conference proceedings, and book chapters split almost evenly between those two areas.

Tougaw has been an active member of ASEE since 2000, beginning with service as the Valparaiso University campus representative. He also served as the Illinois/Indiana Section newsletter editor, Section chair, and Section Annual Conference co-chair three times. He has received the Outstanding Teaching Award, the Outstanding Service Award, and the Outstanding Campus Representative Award from the Illinois/Indiana Section. He also received the Outstanding Paper Award for the Section Conference three times and the Outstanding Zone Paper award at the national conference in 2007.

Tougaw completed a four-year sequence of officer positions in the Ethics Division, including serving as the Division chair during 2010-2011. He has also chaired two national ad hoc ASEE committees related to ethics: the first of these revised the Board of Directors Statement on Engineering Ethics Education, and the second wrote the first-ever ASEE Code of Ethics. Both of those documents were approved unanimously by the entire ASEE Board of Directors.

He served on the Board of Directors as Zone II chair during 2010-2012. During that time, he also participated in the Membership Policy Committee, the Long-Range Planning Committee, and the Nominating Committee. In 2011, Tougaw was appointed as one of three members of the inaugural ASEE Audit Committee. He served as secretary of that committee in 2012-2013 and is currently serving as chair of the committee.

Most recently, he worked with two colleagues from Valparaiso University to create the Section Workshop on Effective Engineering Teaching (SWEET), which was held for the first time in April 2013.

CANDIDATE'S STATEMENT

This is an exciting and challenging time to be a member of our profession. Every year, new technologies are being developed that offer the potential to promote student learning, while rigorous pedagogical research continues to improve our understanding of how students learn. Simultaneously, though, technological developments and societal pressures are also presenting new challenges for our profession. We are not immune to the increasing financial stresses being faced by the field of higher education, nor can we ignore the increasing on-line competition for our students' minds and energies. We are in the midst of a time of transition, and ASEE is perfectly positioned to help lead that transition.

I have been very actively involved in ASEE throughout my career, assuming many leadership positions of increasing responsibility and service to the organization's members. I believe that these experiences have helped prepare me well for the position of vice president for member affairs. I have seen how the person in this position can help to strengthen the geographic sections and zones, which are in turn able to provide a higher level of service to our members.

I have also seen that high-quality section conferences are valuable opportunities for our members to share their pedagogical innovations and to learn from similar work being done by others. I will work hard to increase the value of the section conferences, which provide a lower-cost opportunity for all members of our profession to develop a community of practice with others who share their desire to help students. One way to achieve this goal is with a series of pre-conference workshops to promote best practices in engineering and engineering technology education, which will increase attendance at the conference while also providing greater value to those who attend.

As vice president for member affairs, I will work closely with section and zone chairs to develop innovative programs that provide value to our members across the nation. I will work with campus representatives to help them recruit new members and to offer valuable pedagogical activities on their campuses. I will work with K-12 educators to attract more students to the engineering profession, especially women and those from underrepresented minorities. Most important, I will work with all ASEE members to learn how the Society can best serve their needs.

I am honored to be nominated as the vice president for member affairs, and if elected, I promise to work diligently on your behalf.

CANDIDATES FOR THE OFFICE OF CHAIR, PROFESSIONAL INTEREST COUNCIL II

MARJAN EGGERMONT
Associate Dean and Senior Instructor, Mechanical and Manufacturing Department, Schulich School of Engineering
University of Calgary

Marjan Eggermont is the current associate dean (Student Affairs) and a senior instructor and a faculty member in the Mechanical and Manufacturing Department of the Schulich School of Engineering, University of Calgary, Canada. She teaches graphical, written, and oral communication in the first Engineering Design and Communication course taught to all 750 incoming engineering students. She also teaches Technology and Society to third- and fourth-year students and a graduate course

entitled Biomimetics for Engineers. Marjan teaches visualization, drawing, design history, biomimicry, and green engineering topics. She is interested in biomimicry as a teaching tool because it allows for a great deal of creativity and "bridging" of subjects: science, engineering, design, art, biology, and chemistry.

Eggermont is a Biomimicry Institute Fellow and is a member of its Biomimicry Educational Advisory Board. With co-editors Tom McKeag (San Francisco) and Norbert Hoeller (Toronto) she co-founded and designs ZQ, an online journal to provide a platform to showcase the nexus of science and design using case studies, news and articles (*zqjournal.org*).

In addition, she has a background in fine arts and military history and she is currently a Ph.D. candidate in computational media design specializing in biomimetic computation.

As an artist, Eggermont has exhibited her innovative work both nationally and internationally. She was also named in 2003 as one of the 20 most influential artists in Calgary by the Calgary Artwalk Society and was one of 45 international artists featured in *Printmaking at the Edge* by Richard Noyce (2006). She recently completed a large installation piece for the new EEEL Building (Energy, Environmental, Experiential Learning Building) at the University of Calgary, which is jointly financed by the U of C Alumni Association, the Students Union, and the graduating class of 2010 as the first ever legacy gift to the campus. Eggermont is interested in materials and transformative processes. This has led her to investigate nontraditional materials, including steel, copper, concrete, acrylic, and ceramics.

As an instructor, she was one of the 2004 recipients of the Allan Blizzard Award, a Canadian national teaching award for collaborative projects that improve student learning. In 2005, she was one of the recipients of the American Society of Mechanical Engineers Curriculum Innovation Award. She is the outgoing chair of ASEE's Design in Engineering Education Division.

JEFFREY L. RAY
Dean of the School of Engineering Technology and Management, Professor of Mechanical Engineering Technology
Southern Polytechnic State University

Jeffrey L. Ray has been dean of the School of Engineering Technology and Management and professor of mechanical engineering technology at Southern Polytechnic State University (SPSU) in Marietta, Ga., since 2007. Prior to joining SPSU, he was director of the School of Engineering and professor of mechanical engineering for 10 years at Grand Valley State University, where he developed and led multidisciplinary industry-sponsored capstone design courses. Before joining Grand Valley State University, he was an assistant professor of mechanical engineering at Youngstown State University. His degrees include both B.S. and M.S. degrees in mechanical engineering from Tennessee Technological University and a Ph.D. from Vanderbilt University. While at Vanderbilt, he worked for the Department of Orthopaedics performing biomedical engineering research. Before beginning engineering school, Ray completed an apprenticeship and was awarded the title of journeyman industrial electrician.

Since joining ASEE in 1994, Ray has been an active member at both national and sectional levels. He currently serves as chair of the Engineering Technology Council and vice president, Institutional Councils, and he has served as a member of the Engineering Technology Council board since 2008. Other divisional and society service includes membership in the Frederick Berger Award committee; National Teaching Award committee, and the ASEE Bylaws and Constitution committee. Additionally, Ray has been a reviewer, moderator, and author in the Engineering Technology Division and other ASEE divisions at both national and sectional levels since joining the society. Honors include two Best Session awards at the Conference on Industry Education Collaboration in 2008 for the Cooperative Engineering Education Division and 2013 for the Engineering Technology Division. He also served as a Year of Dialogue leader for the North Central Section and as the 2009 chair of the Southeastern Section annual conference.

As a faculty member, administrator, and volunteer in ASEE and other professional societies over the past 20 years, Ray has gained much experience developing leadership and other skills applicable to the position of PIC II chair. Being an active member of ASEE at all levels has provided many exciting and rewarding experiences during his engineering and engineering technology education career. Ray has worked collaboratively on issues of multidisciplinary and K-12 education topics with ASEE members and staff personnel to move the Society forward. He is dedicated to working with all PIC II divisions for continued success of the current and future directions of the divisions in achieving their goals.

CANDIDATES FOR THE OFFICE OF CHAIR, PROFESSIONAL INTEREST COUNCIL III

ANNA DOLLÁR
Professor of Mechanical Engineering
Miami University

Anna Dollár serves as professor of mechanical egineering at Miami University in Oxford, Ohio. She received both her master's and doctoral degrees in mechanical engineering from Krakow University of Technology in Poland. She also held a postdoctoral position at Carnegie Mellon University (CMU) in Pittsburgh and was on the faculty of the Illinois Institute of Technology (IIT) in Chicago.

Dollár's research has focused on mechanics of solids and engineering education. She is a recipient of several grants pertaining to engineering education, including an award from the National Science Foundation, and two awards from the Hewlett Foundation. She also has a strong record of publication devoted to engineering education and educational research including three papers in the *International Journal of Engineering Education*, one paper in the *Journal of Engineering Education*, one JEE Selects article in *Prism*, and 20 papers in peer-reviewed conference proceedings. The Mechanics Division of ASEE has recognized the quality of her papers and presentations with three "Best Paper" awards and three "Best Presentation" awards.

Recently, Dollár co-authored an interactive, web-based course in engineering statics, supported by the grants from the Hewlett Foundation and NSF. This open and free resource (part of the Carnegie Mellon Open Learning Initiative) includes over 300 interactive exercises with individualized hints and feedback for students. A Learning Dashboard provides information on students' learning in readily accessible form to instructors. The course has been used by thousands of learners all over the world.

She is a recipient of many teaching awards, including the ASEE North Central Section Outstanding Teacher Award (2011) and the University Excellence in Teaching Award at IIT (1998).

An active member of ASEE since 1997, Dollár has a strong record of service and activity, serving as chair (2010- 2012), chair-elect and program chair (2008- 2010), and member of the executive committee (2004 – present) of the Mechanics Division. She was an invited speaker at the main plenary session at the ASEE Annual Conference and Exposition (2011). She also served as session chair at numerous conferences devoted to engineering education and educational research and as a reviewer for *Advances in Engineering Education*, the *International Journal of Engineering Education*, and the *Journal of Engineering Education*, among other publications. She was an invited speaker and panelist at various forums, including the National Academy of Engineering Frontiers of Engineering Education workshop for engineering faculty (2011).

SHERYL SORBY
Fulbright Scholar, Dublin Institute of Technology, Visiting Professor, Engineering Education and Innovation Center
Ohio State University

Sheryl Sorby is currently a Fulbright Scholar at the Dublin Institute of Technology in Ireland and a visiting professor in the Engineering Education and Innovation Center at Ohio State University. She is a professor emerita of mechanical engineering-engineering mechanics at Michigan Technological University and the PI or coPI on more than $8 million in grant funding, mostly for educational projects. Formerly, she was associate dean for academic programs in the College of Engineering at Michigan Tech. She served at the National Science Foundation as a program director in the Division of Undergraduate Education from January 2007 through August 2009. Prior to her appointment as associate dean, Sorby served as chair of the Engineering Fundamentals Department at Michigan Tech. In this capacity, she was responsible for the development and delivery of the newly adopted First-year Engineering Program. She received a B.S. in civil engineering, an M.S. in engineering mechanics, and a Ph.D. in mechanical engineering-engineering mechanics, all from Michigan Tech. Sorby has a well-established research program in spatial visualization and is actively involved in the development of various educational programs. She has published more than 60 papers in journals and conference proceedings and is the author of seven textbooks.

Sorby has been a member of ASEE since 1991 and has served the Society in various capacities. She was chair of the Engineering Design Graphics

Division in 2002 and has served as program chair for EDGD for several conferences. She was director of programs for EDGD from 2010 to 2013. In addition, she was conference chair of the 2010 midyear meeting of EDGD. She is one of the inaugural associate editors of *Advances in Engineering Education*, ASEE's online journal.

She received the North Midwest Section of ASEE's Dow Outstanding New Faculty Award in 1996 and the Distinguished Teaching Award in 1998. She also received the Distinguished Service Award from the Engineering Design Graphics Division of ASEE in 2007. In 2005 she received the Betty Vetter award for Research on Women in Engineering through the Women in Engineering Pro-Active Network (WEPAN) for her work in improving the 3-D spatial skills of engineering students. In 2009 she was inducted as a fellow of ASEE and in 2011 she received the Society's Sharon Keillor Award as an oustanding woman engineering educator.

MEET YOUR STAFF

Telling the Science Story

Sarah Khan is the newest young talent in one of ASEE's most dynamic units, the Editorial Department.

Her day-to-day activities include serving as the managing editor of *The Accelerator*, ASEE's newsletter for undergraduate and graduate students, and assistant editor of *Prism*, writing pieces and contributing intellectually and conceptually to story ideas. She also manages the technical/website elements of the quarterly *Advances in Engineering Education*. Sarah has even sneaked in work as picture model, carrying a tray of diverse delectables on Page 31 of the September *Prism*.

Sarah was born in Baltimore to Pakistani immigrants and has been around big brains all her life. Both parents are computer engineers (her sister currently studies computer science), and when Sarah left home for school, she went across the country to study physics at UCLA. Further, immediately prior to joining ASEE, she was an intern at Fermilab.

So where do the reporting chops come in? "I always had an interest in writing, and immediately after college I had an internship with the *Orlando Sentinel*," she says. "I got to work with their only health reporter, and it was right around the time the Affordable Care Act was coming around – it was a crash course in everything government-health related."

This combination of solid writing and deep interest in science allows Sarah to report deftly on a variety of topics for ASEE members, including the audio-preservation work of MacArthur "genius" grant winner Carl Haber, whose Up Close profile appears on Page 18.

National Native American Heritage Month

Native American engineers and scientists have made notable contributions to education, exploration, and research. In recognition of National Native American Heritage Month, ASEE honors these homegrown high achievers.

MARY G. ROSS. (Cherokee) A former science teacher and the only woman engineer on Lockheed's original Missile Systems Division team, the aerospace engineer's contributions to space exploration include work on the Apollo program, the Polaris reentry vehicle, and flyby probes of Mars and Venus.

SANDRA BEGAY-CAMPBELL. (Navajo) A structural engineer, as head of Sandia National Laboratories' Tribal Energy Program she works to bring solar power to remote Native American communities and created internships to train a new generation of renewable-energy advocates.

DAVID MONIAC. (Creek) The first Native American and first minority graduate from the U.S. Military Academy, class of 1822, the Army engineer is distinguished as the only Native American commissioned as an officer during the Second Seminole War. He was killed in action during that war at the Battle of Wahoo Swamp.

AARON THOMAS. (Navajo) An assistant professor in the department of chemical and materials engineering at the University of Idaho and director of the Idaho Space Grant Consortium, the microfluidics expert won a Presidential Early Career Award for Scientists and Engineers in 2009 for innovative research and his outreach efforts to Native American and Alaska Native students.

JOHN BENNETT HERRINGTON. (Chickasaw) The Navy test pilot and aeronautical engineer became the first Native American astronaut to fly and walk in outer space when he docked the Space Shuttle Endeavour to the International Space Station in 2002. Now retired, he speaks to youth groups about math and science and is pursuing a Ph.D. in education.

2013 ASEE AWARDS

OUTSTANDING ZONE CAMPUS REPRESENTATIVE AWARD

This award was established to honor outstanding Zone Campus Representatives.

Each award winner receives a plaque.

ZONE I
Surendra Gupta
Rochester Institute of Technology

ZONE II
Christopher J. Rowe
Vanderbilt University

ZONE III
Kevin Drees
Oklahoma State University

ZONE IV
David Lanning
Embry-Riddle Aeronautical University, Prescott

ASEE COUNCIL AWARDS

ASEE CORPORATE MEMBER COUNCIL EXCELLENCE IN ENGINEERING EDUCATION COLLABORATION AWARDS

Driving Science

DuPont and Clemson University

Letha A. Hammon, DuPont

PACE PARTNERS FOR THE ADVANCEMENT OF COLLABORATIVE ENGINEERING EDUCATION GLOBAL COLLABORATIVE PROJECT COMPETITION INITIATIVE

General Motors Co.

Siemens PLM Software

Autodesk

Hewlett-Packard

Oracle, Vass Theodoracatos

Hulas King, Siemens PLM Software

ASEE ENGINEE RING RESEARCH COUNCIL CURTIS W. MCGRAW RESEARCH AWARD

Christopher W. Jones
Georgia Institute of Technology

ASEE SECTION AWARDS

SECTION OUTSTANDING TEACHING AWARD

This award, given by each ASEE section, recognizes the outstanding teaching performance of an engineering or engineering technology educator. The award consists of a framed certificate and an appropriate honorarium presented by the local section. Following are this year's award recipients.

GULF SOUTHWEST SECTION
Nadir Yilmaz
New Mexico Institute of Mining & Technology

ILLINOIS/INDIANA SECTION
Jeff Will
Valparaiso University

MIDDLE ATLANTIC SECTION
Robert Brooks
Temple University

NORTH CENTRAL SECTION
Kathleen A. Ossman
University of Cincinnati

PACIFIC NORTHWEST SECTION
Brock J. LaMeres
Montana State University

PACIFIC SOUTHWEST SECTION
Avelino Eduardo Saez
University of Arizona

SOUTHEAST SECTION
Elliot Douglas
University of Florida

ST. LAWRENCE SECTION
Sinéad C. MacNamara
Syracuse University

SECTION OUTSTANDING CAMPUS REPRESENTATIVE AWARD

ASEE's Campus Liaison Board initiated this award to recognize those ASEE campus representatives who have demonstrated staunch support for ASEE on their campuses. The award consists of a framed certificate of recognition and is presented at each section's annual meeting. Following are this year's award recipients.

ILLINOIS/INDIANA SECTION
Doug Tougaw
Valparaiso University

MIDWEST SECTION
Kevin Drees
Oklahoma State University

NORTHEAST SECTION
Kanti Prasad
University of Massachusetts-Lowell

NORTH CENTRAL SECTION
Christopher P. Pung
Grand Valley State University

PACIFIC NORTHWEST SECTION
Carolyn Labun
University of British Columbia

PACIFIC SOUTHWEST SECTION
David Lanning
Embry-Riddle Aeronautical University, Prescott

SOUTHEAST SECTION
Christopher J. Rowe
Vanderbilt University

ST. LAWRENCE SECTION
Surendra Gupta
Rochester Institute of Technology

OTHER SECTION AWARDS

GULF SOUTHWEST SECTION
Section Mile Award
University of New Mexico

Faculty Best Paper Awards
FIRST PLACE
David H. K. Hoe
The University of Texas at Tyler
Paper: "The Impact of Peer Interaction Exercises in a Signals and Systems Course"

SECOND PLACE
Siamak (Sia) A. Ardekani
The University of Texas at Arlington
Paper: "Is Distance Education Distant Education?"

THIRD PLACE
Hector A. Ochoa
The University of Texas at Tyler
Paper: "The Implementation of Take Home Laboratories Using the NI myDAQ"

Student Best Paper Awards
FIRST PLACE
Chaudhry Arafat, Mohammad R. Hasan, and Samir M. Iqbal
The University of Texas at Arlington
Paper: "Auto-imaging, Predefined Stepping and Exposure Through Submicron 3-Axis Inspection Microscope"

SECOND PLACE
Priscila Martinez-Avila, Emmanuel Varona, Doug D. Carlton Jr., Abegayl Thomas, and Kevin A. Schug
The University of Texas at Arlington
Paper: "Evaluating Effects of the Arlington Undergraduate Research-based Achievement for STEM (AURAS) Program on the Performance of Engineering Students in Chemistry Courses"

THIRD PLACE
Amen Omoragbon, Gary Coleman, Lex Gonzalez, Brandon Watters, and Bernd Chudoba
The University of Texas at Arlington
Paper: "Feasibility Study of a Thrust Vector Control Transport"

ILLINOIS-INDIANA SECTION
Outstanding Service Award
Tom Trusty
Trine University

Outstanding Paper Award
Doug Tougaw & Jeff Will
Valparaiso University
Paper: "Problem-Based Learning to Promote Creativity"

MIDWEST SECTION
Person Mile Award
University of Arkansas-Fayetteville

Outstanding Paper Awards
FIRST PLACE
Christi Patton-Luks, Laura Ford, and Weston Kightlinger
University of Tulsa
Paper: "Solar Water Heaters for Showers and Sinks: An EWB-USA Project"

SECOND PLACE
M. Ryan Bales
Georgia Tech
Steve E. Watkins
Missouri University of Science and Technology
Paper: "Video Surveillance Analysis as a Context for Embedded Systems and Artificial Intelligence Education"

THIRD PLACE
Diane Hagni and Harvest Collier
Missouri University of Science and Technology
Paper: "Establishing a Faculty Development Focus at a Public Technological Research University"

Outstanding Student Poster Award
Christopher James and B. Terry Beck
Kansas State University
"Weight Reduction Methods for the SAEAero Design Competition"

Outstanding Service Award
Steve E. Watkins
Missouri University of Science and Technology

NORTH CENTRAL SECTION
Best Paper Awards
FIRST PLACE
Darrell Kleinke
University of Detroit, Mercy
Paper: "Experiential Education and Broad Value Creation Is Enabled by the Disabled"

SECOND PLACE
David L. Tamasko, Judy S. Ridgway, Susan V. Olesik, Rocquel J. Waller, Minnie M. McGee, Lisa A. Barclay, Kathleen T. Harkin
Ohio State University
Jan Upton
Institutional Research Consultants, Ltd.
Paper: "Impact of Summer Bridge Programs on STEM Retention at the Ohio State University"

THIRD PLACE
Joshua Stuckey and Mark Archibald
Grove City College
Paper: "Sophomore Machine Shop Experience Constructing a Spring-Powered Car"

NORTH MIDWEST SECTION
Outstanding Educator Award
Kevin C. Craig
Marquette University

PACIFIC NORTHWEST SECTION
Best Paper Award
Ken R. Fyfe and Jeffrey A. Davis
MacEwan University
Paper: "Automated Generation of Randomizable Problem Sets and Detailed Solutions for a First-Year Course in Engineering Statics"

PACIFIC SOUTHWEST SECTION
Student of the Year Award
Jose Edid Garcia
Embry-Riddle Aeronautical University, Prescott

Outstanding Community College Educator Award
Ann-Marie Vollstedt
Truckee Meadows Community College

ROCKY MOUNTAIN SECTION
Best Paper Award
Angela R. Bielefeldt
University of Colorado
Paper: "Student Perceptions of the Importance and Achievement of Sustainable Engineering Outcomes"

Best Presentation Award
Mark Bedillion
South Dakota School of Mines
Paper: "SolidWorks in Dynamics"

SOUTHEAST SECTION
New Faculty Research Awards
FIRST PLACE
Michael Dickey
North Carolina State University

SECOND PLACE
Marian Kennedy
Clemson University

Outstanding Mid-Career Teaching Award
Lisa Bullard
North Carolina State University

Thomas C. Evans Instructional Paper Award
Tanya Kunberger
Florida Gulf Coast University

PROFESSIONAL AND TECHNICAL DIVISION AWARDS

AEROSPACE ENGINEERING DIVISION
John Leland Atwood Award
Mark D. Maughmer
Professor, Department of Aerospace Engineering
Pennsylvania State University

This award was established in 1985 in honor of Lee Atwood, a master of aviation and a pioneer in missile and space projects. It is bestowed annually upon an outstanding aerospace engineering educator in recognition of contributions to the profession. The award is endowed by Rockwell International and consists of a $2,000 honorarium, a certificate, and reimbursement of travel expenses to the ASEE Annual Conference. The American Institute of Aeronautics and Astronautics also presents an engraved medal and a certificate to the recipient at its annual aerospace sciences meeting.

ELECTRICAL ENGINEERING DIVISION-
Frederick Emons Terman Award
Mung Chiang
Professor, Electrical Engineering Department, Director of Graduate Studies
Princeton University

This award is conferred upon an outstanding young electrical engineering educator in recognition of contributions to the profession. The award, established in 1969, is sponsored by the Hewlett-Packard Co. and consists of a $4,000 honorarium, a gold-plated medal, a bronze replica, a presentation scroll, and reimbursement of travel expenses for the awardee to attend the ASEE Frontiers in Education Conference, where the award will be presented

Mechanical Engineering Division Ralph Coats Roe Award
Rajendra Singh
Donald D. Glower Chair in Engineering, Professor, Mechanical Engineering Department
Ohio State University

This award honors an outstanding mechanical engineering teacher who has made notable contributions to the engineering profession. Financed from an endowment established by Kenneth A. Roe of Burns and Roe Inc. in honor of his father, Ralph Coats Roe, the award consists of a $10,000 honorarium, a plaque, and reimbursement of travel expenses to attend the ASEE Annual Conference.

OTHER DIVISION AWARDS

BIOLOGICAL AND AGRICULTURAL ENGINEERING DIVISION
Excellence in Teaching Materials and

Methods Award
R. Paul Singh
University of California, Davis

BIOMEDICAL ENGINEERING DIVISION

Theo C. Pilkington Outstanding Educator Award
Ann Saterbak
Rice University

Biomedical Engineering Teaching Award
Michael Rust
Western New England University

CHEMICAL ENGINEERING DIVISION

William H. Corcoran Award
Donald R. Woods
McMaster University

CACHE Award
Edward M. Rosen
Monsanto Chemical Co.

Chemstations Chemical Engineering Lectureship Award
Clayton J. Radke
University of California, Berkeley

Joseph J. Martin Award
Matthew Cooper, Lisa G. Bullard, Steven W. Peretti, and David F. Ollis
North Carolina State University

Ray W. Fahien Award
Matthew W. Liberatore
Colorado School of Mines

Lifetime Achievement Award in Chemical Engineering Pedagogy
Ronald W. Rousseau
Georgia Institute of Technology

CIVIL ENGINEERING DIVISION

George K. Wadlin Distinguished Service Award
Jim L. Hanson
California Polytechnic State University, San Luis Obispo

Glen L. Martin Best Paper Award
Col. Stephen J. Ressler
U.S. Military Academy
Paper: "To Raise the Bar or Not: Addressing the Opposition"

COLLEGE/INDUSTRY PARTNERSHIPS DIVISION

CIEC Best Session Award
Presenter: Ranji Vaidyanathan
Oklahoma State University
Moderator: Cath Polito
University of Texas-Austin
"The Challenges of Addressing IP and ITAR Issues in a University Setting"

CIEC Best Presenter Award
Presenters: Bob Schwartz
Missouri University of Science and Technology
Henry Wiebe
Missouri University of Science and Technology
Sarah Bock
Covidien
"The Role of Corporate Partners in Student and Graduate Success"

CIEC Best Moderator Award
Beth Bryant,
Georgia Institute of Technology
"Innovative Senior Project Program Partnering University/Corporate Partners"

COMPUTERS IN EDUCATION DIVISION

John A. Curtis Lecture Award
Barry E. Mullins
Air Force Institute of Technology
Paper: "Developing Cyber Warriors from Computer Engineers et al."

Woody Everett Best Poster Award
Thalia Anagnos
San Jose State University
Alicia L. Lyman-Holt
Oregon State University
Sean P. Brophy
Purdue University
"Work-in-Progress: Linking a Geographically Disturbed REU Program With Networking and Collaboration Tools"

CONTINUING PROFESSIONAL DEVELOPMENT DIVISION

Joseph M. Biedenbach Distinguished Service Award
Andy DiPaolo
Stanford University

Certificate of Apreciation
Ellen J. Elliott
2013 CPDD Program Chair
Johns Hopkins University
Lynda M. Coulson
2010-2013 CPDD Director
Rolls-Royce Corp.
Greg Ruff
2011-2013 CPDD Treasurer
Auburn University

Certificate of Merit International Leadership in CPD
Nelson Baker
Georgia Institute of Technology

Leadership in CPD Online Initiative
Thomas Brumm
Iowa State University

CIEC Best Session Award
Presenters: Kim Scalzo
SUNY Center for Professional Development
Ed Borbeley
University of Michigan
Nelson Baker
Georgia Institute of Technology
Moderator: Ellen Elliott
Johns Hopkins University
"Operational Excellence in Professional Education: Assessing the Present, Sharing Good Practices, and Charting the Future"

CIEC Best Conference Presenter Award
Wayne Pferdehirt
University of Wisconsin, Madison
"Optimizing Group Projects for Practicing Engineers in an Online Environment: Lessons Learned"

Best Moderator Award
Rita Burrell
Mississippi State University
"Vietnam Higher Engineering Education-Alliance Program (HEEAP)"

COOPERATIVE AND EXPERIENTIAL EDUCATION DIVISION

Lou Takacs Award
Gary Pennell
Nucor-Yamato Steel Co.

Alvah K. Borman Award
Gayle Elliott
University of Cincinnati

CIEC - Best Presenter Award
Chris Plouff
Grand Valley State University
"Integration of Professional Skills and Academic Content During Co-op Semesters Via Distance Learning Modules: Review of Results From a Pilot Program"

CIEC – Best Moderator Award
Naomi Powell
University of Alabama
"Introducing Engineering Students to the 'Junior Game'"

CIEC – Best Session Award
Presenters: Lorraine Mountain and Karen Kelly
Northeastern University
Moderator: Louise Carrese
Rochester Institute of Technology
"Creative Job Development Strategies in a Slow Economy"

Co-op Student of the Year Award
Benjamin Lee Ko
University of Cincinnati

CEED Intern of the Year Award
Kirk Barber
Indiana University-Purdue University, Indianapolis

DIVISION OF EXPERIMENTATION AND LABORATORY ORIENTED STUDIES (DELOS)

Best Paper Awards
Nebojsa I. Jaksic
Colorado State University, Pueblo
"DaNI-K: A Vision-based Robot Control Experiment with a DaNI Robot and Kinect Sensor Bundle"

EDUCATIONAL RESEARCH & METHODS DIVISION

Distinguished Service Award
Richard Layton
Rose-Hulman Institute of Technology

Helen L. Plants Award
Senay Purzer
Purdue University, West Lafayette
Johnathan Hilpert
Georgia Southern University

Ronald J. Schmitz Award for Outstanding Contributions to the Frontiers in Education Conference
Arnold Pears
Uppsala University

Benjamin Dasher Award
Kristi J. Shryock, Arun R. Srinivasa, and Jeffrey E. Froyd
Texas A&M University

Best Paper Award
Alice Pawley
Purdue University, West Lafayette

Apprentice Faculty Grant
Samantha Brunhaver
Stanford University
James Huff
Harding University
Mahnes Jean Mohammadi-Aragh
Virginia Tech
Diane Peters
University of Michigan
Kathryn Trenshaw
University of Illinois, Urbana-Champaign

ELECTRICAL AND COMPUTER ENGINEERING DIVISION

Meritorious Service Award
Susan M. Lord
University of San Diego

Distinguished Educator Award
Cheryl B. Schrader
Missouri University of Science and Technology

ENERGY CONVERSION AND CONSERVATION DIVISION

Best Paper Awards
FIRST PLACE
Madhumi Mitra
University of Maryland Eastern Shore
Abhijit Nagchaudhuri
University of Maryland, Eastern Shore
Corinne Johnson Rutzke
Cornell University
Paper: "Energizing the STEAM Curricula With Bioenergy and Bioproducts"

SECOND PLACE
Oxana S. Pantchenko
University of California, Santa Cruz
Tiffany Wise-West
University of California, Santa Cruz
Michael S. Isaacson
University of California, Santa Cruz
Ali Shakouri
Purdue University
Paper: "Enhancing Student Learning Through a Real-World Project in a Renewable Energy Sources Course"

THIRD PLACE
Hayrettin B Karayaka
Western Carolina University
Mehrube Mehrubeoglu
Texas A&M University, Corpus Christi
Paper: "Nuclear Workforce Development Scholarships and Enhancements Program Phase I: Outreach and Recruiting"

ENGINEERING DESIGN GRAPHICS DIVISION

Distinguished Service Award
Judith Birchman
Purdue University

Oppenheimer Award
Diarmaid Lane, Niall Seery, and Seamus Gordon
University of Limerick

Chair's Award
Thomas Delahunty, Niall Seery, Raymond Lynch, and Diarmaid Lane
University of Limerick

Editor's Award
Ted Branoff
North Carolina State University
Modris Dobelis
Riga Technical University
Engineering Design Graphics Journal, Volume 76

Media Showcase Award
Thomas Delahunty
University of Limerick

ENGINEERING ECONOMY DIVISION

Eugene L. Grant Award
Arthur T. Cox and Richard Followill
University of Northern Iowa
"The Equitable Financing of Growth: A Proportionate Share Methodology for Calculating Individual Development Impact Fees" (*The Engineering Economist*, Volume 57, Number 3, Pages 141-156)

Best Paper Award
Lizabeth T. Schlemer
California Polytechnic State University
"Project-Based Learning in Engineering Economics: Teaching Advanced Topics Using a Stock Price Prediction Model"

ENGINEERING LIBRARIES DIVISION

Homer I. Bernhardt Distinguished Service Award
Paige Gibbs
University of Massachusetts, Dartmouth

Best Publication Award
Ashok Naimpally
Fresno City College
Hema Ramachandran
California State University, Long Beach
Caroline Smith
University of Nevada, Las Vegas
"Lifelong Learning for Engineers and Scientists in the Information Age"

ENGINEERING MANAGEMENT DIVISION

Merl Baker Award
Neal Lewis
University of Bridgeport

Best Paper Award
LaTondra Murray
Duke University
Paper: "Developing Community for Distance Learners in an Engineering Management Program"

Best Presentation Award
Presenter: Kathryn Abel
Stevens Institute of Technology
"Proposing a Framework for Restructuring an Introductory Engineering Management Course for Undergraduates"

ENGINEERING PHYSICS DIVISION

Distinguished Educator and Service Award
Baha Jassemnejad
University of Central Oklahoma

ENGINEERING TECHNOLOGY DIVISION

CIEC – Best Paper Award
Chih-Ping Yeh
Wayne State University
Gene Yeau-Jian Liao
Wayne State University
Joseph L. Petrosky
Macomb Community College
Paper: "A University and Community College Partnership to Meet Industry Needs for Future Workers in Advanced Automotive Technology"

CIEC – Best Presenter Award
Presenter: Jon Fischer
California Maritime Academy
"Hands-On Project to Improve Mechanical Analysis Skills: A Comparative Study"

CIEC - Best Session Award
Presenters: Gary Bertoline
Purdue University
Jeffrey Ray
Southern Polytechnic State University
H. Fred Walker
Rochester Institute of Technology
Moderator: Ken Burbank
Purdue University
"The Future of Engineering Technology: Dean's Perspective"

CIEC – Best Moderator Award
Moderators: Walt Buchanan and Angie Hill Price
Texas A&M University
"Methods to Improve Instruction and Job Success in Engineering Technology"

ENVIRONMENTAL ENGINEERING DIVISION

Best Paper Award (Faculty)
Jeffrey A. Cunningham
University of South Florida
Sukalyan Sengupta
University of Massachusetts, Dartmouth
Sarina J. Ergas
University of South Florida
Ramesh K. Goel
University of Utah
Dilek Ozalp
University of South Florida
Teri Reed-Rhoads
Purdue University, West Lafayette
Paper: "Development of a Concept Inventory for Introductory Environmental Engineering Courses"

Best Student Paper Award
Alexandre Wing, Cristal Hibbard, Jennifer Strong, Jörg Drewes, and Junko Munakata Marr
Colorado School of Mines
Paper: "Sustainable Water: Development, Delivery, and Assessment of K-5 Modules"

Early Career Grant
Youngwoo Seo
The University of Toledo
"Interdisciplinary Approach to Address the Dynamics of Water Distribution Systems for Engineering Student Education"

INDUSTRIAL ENGINEERING DIVISION

Best Paper Award
Saylisse Davila, Viviana Cesani, and Alexandra Medina-Borja
University of Puerto Rico, Mayaguez
Paper: "Measuring Intercultural Sensitivity: A Case Study of the REU Program at UPRM"

Distinguished Service Award
Terri Lynch-Caris
Kettering University

New IE Educator Outstanding Paper Award
Denis H. Bauer
University of Idaho
Jessica Heier Stamm
Kansas State University
Lesley Strawderman
Mississippi State University
Paper: "Review of Capstone Course Designs Used in Industrial Engineering Programs"

Yosef S. Allam
Embry-Riddle Aeronautical University, Daytona Beach
Scott Sink
Ohio State University
John A. Merrill
Ohio State University
Paper: "A Metric-Based, Hands-On Quality and Productivity Improvement Stimulation Involving Lean and Sigma Concepts for First-Year Engineering Lab Students"

GRADUATE STUDIES DIVISION

Donald Keating Award
Stephen J. Tricamo
New Jersey Institute of Technology

Distinguished Service Award
Terri Lynch-Caris
Kettering University

LIBERAL EDUCATION DIVISION

The Sterling Olmstead Award
Vivian Weil
Illinois Institute of Technology

MATHEMATICS DIVISION

Distinguished Educator and Service Award
Henry Zwick
Utah State University-College of Eastern Utah

Best Paper Award
Helen M. Doerr
Syracuse University
Andria Costello Staniec
Syracuse University
AnnMarie H. O'Neil
C.S. Driver Middle School
Paper: "Designing for Improved Success in First-Year Mathematics"

MECHANICAL ENGINEERING DIVISION

Outstanding New Mechanical Engineering Educator Award
Carolyn Connor Seepersad
The University of Texas at Austin

MECHANICS DIVISION

Archie Higdon Distinguished Educator Award
James W. Dally
University of Maryland, College Park

Ferdinand P. Beer and E. Russell Johnston, Jr. Outstanding New Mechanics Educator Award
Charles Riley
Oregon Institute of Technology
Douglas P. Holmes
Virginia Tech

Best Paper Award
Janet Y. Tsai, Daria A. Kotys-Schwartz, and Michael Hannigan
University of Colorado-Boulder
Paper: "Learning Statics by Feeling: Effects of Everyday Examples on Confidence and Identity Development"

Best Presentation Award
Paul Steif
Carnegie Mellon University
Anna Dollar
Miami University
"Relating Usage of Web-Based Learning Materials to Learning Progress"

MULTIDISCIPLINARY ENGINEERING DIVISION

Best Paper Award
Darshita Shah, Jennifer French, Janet Rankin, and Lori Breslow
Massachusetts Institute of Technology
Paper: "Using Video to Tie Engineering Themes to Foundational Concepts"

PHYSICS DIVISION

Distinguished Educator and Service Award
Baha Jassemnejad
University of Central Oklahoma

SYSTEMS ENGINEERING DIVISION

Best Paper Award
Lisa Guerra, Gloria Murphy, and Lisa May
National Aeronautics and Space Administration (NASA)
Paper: "Applying Systems Engineering to the Lunabotics Mining Competition Capstone Design Challenge"

WOMEN IN ENGINEERING DIVISION

Mara H. Wasburn Apprentice Educator Grant
Elise Marie Barrella
James Madison University
Jennifer Wang
University of California, Berkeley

Best Paper Award
Lorelle Meadows and Denise Sekaquaptewa
University of Michigan
Paper: "The Influence of Gender Stereotypes on Role Adoption in Student Teams"

ASEE CALL FOR AWARD NOMINATIONS

ASEE is currently seeking nominations for awards to be presented at the Awards Banquet of the ASEE Annual Conference and Exposition in Indianapolis, Ind., in June 2014.

All it takes is a little of your time for a deserving colleague to receive national recognition on June 18, 2014, in the presence of an audience of esteemed colleagues in the engineering education community.

Descriptions of all awards, including award criteria, nomination requirements, and online award nomination forms, are available on the ASEE website at **http://www.asee.org/member-resources/awards**. Hard-copy nominations, which will also be accepted, should be sent to:

ASEE
Awards Administration
1818 N Street, N.W., Suite 600
Washington, DC 20036

The deadline for submitting award nominations is Jan. 15, 2014. If you have questions, please call (202) 331-3516 or send an email to **awards@asee.org.**

ASEE NATIONAL AWARDS

Frederick J. Berger Award for Excellence in Engineering Technology Education

Chester F. Carlson Award for Innovation in Engineering Education

Isadore T. Davis Award for Excellence in Collaboration of Engineering Education and Industry

DuPont Minorities in Engineering Award

John L. Imhoff Global Excellence Award for Industrial Engineering Education

Sharon Keillor Award for Women in Engineering Education

Benjamin Garver Lamme Award for Excellence in Engineering Education

Lifetime Achievement Award in Engineering Education

James H. McGraw Award for Excellence in Engineering Technology Education

Merriam/Wiley Distinguished Author Award

Fred Merryfield Design Award

National Engineering Economy Teaching Excellence Award

Robert G. Quinn Award for Excellence in Experimentation and Laboratory Instruction

SOCIETY AWARDS

ASEE President's Award

W. Leighton Collins Award

Distinguished Service Citation

Donald E. Marlowe Award

Fellow Grade Membership

Honorary Membership

Gary Gabriele

'Design Thinking' Champion

Gary Gabriele may be a dean, but he's also living a boyhood dream. Growing up, he loved to build things like soapbox derby racers and imagined a future designing cars. Now, having climbed the academic rungs as teacher, researcher, administrator, and National Science Foundation division director to become head of Villanova University's engineering college, he has cut back on teaching and instead advises the school's Formula SAE team, which designs and builds race cars from the ground up. The team won a fuel economy competition in 2010, setting a record. More important, the noncredit activity affords students "a fabulous engineering learning experience," he says.

"Design thinking" is key to engineering education, in Gabriele's view. At Villanova, it starts with encouraging freshmen to push the envelope and "wrestle with the design process" even if they lack some essential skills. If they can't perform beam equations, for instance, they'll get help. By the time students reach beam equations in the curriculum, they'll understand the importance. Besides design, Villanova stresses undergraduate research. Gabriele says that far from being shortchanged when the school launched an engineering Ph.D. program seven years ago, undergraduate research has grown, as has student satisfaction.

A specialist in the connections among mechanical engineering, design optimization, and manufacturing, Gabriele completed his own doctorate while serving in the Army at a research office based at Georgia Tech. He stays abreast of the government-funded research establishment through ASEE's Engineering Research Council, which he chairs. This active group first came to his attention while he was directing NSF's Engineering Education and Centers division. Comprising mostly associate deans of graduate education and research, it provides a unique platform for federal program managers to spell out their research priorities and thereby attract better proposals, Gabriele says. Villanova has carved out what he says is a "strong presence" in such fields as signal processing, radar, through-the-wall imaging, water resources, and energy.

At 62, confident that Villanova's engineering program is progressing, Gabriele doesn't dismiss the notion of retirement. It would allow more time with his wife, four daughters – one a biomedical engineering professor – and two grandchildren, as well as for multiple hobbies: woodworking, sailing, playing the piano, and – you might have guessed – sports-car racing.

C. Diane Matt

Organizer for Women and Diversity

If diversity is an ASEE commitment, for C. Diane Matt it's a full-time job. As executive director of the Women in Engineering ProActive Network (WEPAN), she plays a leading role in mobilizing experts and disseminating best practices and the latest research on attracting more women to engineering and launching them into academic or industry careers.

WEPAN's mission isn't easy. When Matt joined, the prevailing view among advocates for gender diversity in engineering was one of "add women and stir," she recalls – boost the numbers and the profession would become more female-friendly. "We didn't understand how challenging that would be."

While the percentage of women in engineering remains stubbornly low, word is getting out as to why, thanks in part to WEPAN's conferences, webinars, and storehouse of information. For instance, fewer women than men leave engineering due to poor academic performance, but women are twice as likely to leave because of dissatisfaction with climate, pedagogy, and faculty reluctance to embrace social change. Had the system been designed to drive women away, in fact, it could hardly be more effective.

Word also is spreading about how to fix the problem. As evidenced by Matt's being tapped to chair ASEE's Corporate Member Council, companies are getting wise to the fact that a diverse workforce can bring better design solutions and products. "There are many bright spots," she says. Needed now is a plan of action that draws on the accumulated know-how.

Trained as a geoscientist – and married to one – Matt came to engineering as an environmental planner, teaming up with engineers on pollution control and sound mitigation for Denver public transportation projects. She put her acquired knowledge and grant-writing skills to work forging partnerships for the Geological Society of America and running membership associations for landscape architects and contractors before being recruited by WEPAN. "I really like working with a team to strategically advance the interests of a profession," she says.

Born in Indiana and raised in Connecticut, Matt moved westward for college, graduating from Indiana University and earning a master's at the University of Calgary. She makes the most of Colorado's sun and dry climate, cycling and whitewater rafting in the Grand Canyon. She now has a reason to visit points farther west: Her daughter is a grad student at the Monterrey Institute of International Studies.

How To Place An Ad

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You have the option of either submitting your ad electronically or you can send it via e-mail to get a price quote. Price quotes and confirming e-mails include the cost of the ad per month, though you may want to run your ad consecutively when choosing preferred publication month(s). If you have a question regarding this policy, please feel free to contact the advertising manager.

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JOB BANK

ASEE members can access classified advertisements on the Internet 30 days prior to publication in ASEE Prism. The ads are accessible to the public the first day of the issue month. That means you get 60 days of valuable advertising coverage! The URL to access the classified ads is www.asee.org/classifieds

METHODS OF PAYMENT

We accept purchase orders and credit cards (Visa or MasterCard) as methods of payment. If you submit your ad by e-mail, please include your contact information, which includes: a contact person, billing address, phone number, and fax number. Ads, including those running in consecutive issues, are billed monthly unless your credit card payment or purchase order is generated to cover the total amount of your ad appearing in your chosen issues.

CLASSIFIED ADVERTISING DEADLINE

for January 2014 issue
December 6, 2013
(However deadline dates are subject to change and are posted on the web at: www.asee.org/classifieds)
Please see website for updates.

FACULTY

TENURE-TRACK

CHEMICAL AND BIOMOLECULAR ENGINEERING

The Department of Chemical and Biomolecular Engineering at Lafayette College in Easton, Pennsylvania is pleased to announce a tenure-track position at the Assistant Professor level with appointment to begin July 2014. We seek the best available candidate with preference to those with expertise in energy, advanced materials, or environmental engineering. A strong background in teaching and mentoring, with interests in laboratory-based teaching, multidisciplinary collaboration, and experiential education, is a plus. The ChBE Department has approximately 120 students across all classes and outstanding resources for faculty research and professional development. Lafayette College is a small, private, undergraduate-only institution emphasizing superior education in engineering and the liberal arts. The college is located in eastern Pennsylvania, 70 miles from both New York City and Philadelphia. Applicants should have a Ph.D. in chemical engineering or closely related field. A cover letter, statement of teaching interests, research plans, a curriculum vita, and list of three references should be addressed to: Search Committee, Dept. of Chemical and Biomolecular Engineering. Email applications and questions to: **chbe@lafayette.edu**. Review of applications will begin November 1. Lafayette College is committed to creating a diverse community: one that is inclusive and responsive, and is supportive of each and all of its faculty, students, and staff. All members of the college community share a responsibility for creating, maintaining, and developing a learning environment in which difference is valued, equity is sought, and inclusiveness is practiced. Lafayette College is an equal opportunity employer and encourages applications from women and minorities.

TENURE-TRACK

CHEMICAL AND BIOLOGICAL ENGINEERING

SCHOOL OF CHEMICAL, BIOLOGICAL AND MATERIALS ENGINEERING, UNIVERSITY OF OKLAHOMA FACULTY POSITION OPENING. The School of Chemical, Biological and Materials Engineering (CBME) at The University of Oklahoma invites applications for a tenure track faculty position at the assistant professor level with an expected starting date in fall 2014. Candidates with research expertise in all fields will be considered, but the school is particularly interested in computational research expertise which strengthens existing programs in catalysis, biofuels, interfacial phenomena, and applied surfactant research. Candidates must hold an earned doctorate in chemical engineering or closely related discipline. Salary will be commensurate with experience and qualifications. Successful candidates will be committed to excellence in both research and education, and they will function effectively in a multidisciplinary research environment. CBME offers competitive startup packages, exciting opportunities for research collaboration, and a supportive environment for new faculty. Candidates should send a resume, description of research plans, teaching and outreach interests, and names of three references via email to: **cbme@ou.edu**. Applications will be reviewed until candidates are selected and recommended for appointment. The University of Oklahoma is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

SVSU SAGINAW VALLEY STATE UNIVERSITY

Charles J. Strosacker Endowed Chair of Engineering

The College of Science, Engineering and Technology at Saginaw Valley State University invites applications for the Charles J. Strosacker Endowed Chair of Engineering. This position provides a unique opportunity for creative academic or industrial engineers to contribute expertise and instruction in engineering, exercise leadership in the new Energy & Materials programs, and establish ties between SVSU and industry, community, and governmental agencies, especially within the Great Lakes Bay Region. The Strosacker Endowed Chair will be a leader in designing a collaborative research program involving faculty, students, and area stakeholders.The successful candidate will teach classes in Mechanical or Electrical Engineering and the Masters of Energy and Materials programs.

The individual selected to fill the Chair will have an earned doctorate or equivalent in engineering or a closely-related field, and a successful record of technical responsibilities and achievements in the academic or industrial sectors.

Teaching at the university level is a critical component of this position. Preference will be given to applicants with experience working with government and/or industrial sectors. For complete list of requirements, further information, and to apply for this position, please visit **www.jobs.svsu.edu**. Applicants must apply on-line.

Saginaw Valley State University is an EO/AA employer.
Women and minorities are encouraged to apply.

TENURE-TRACH

CHEMICAL ENGINEERING

FACULTY OPENINGS: ASSISTANT PROFESSOR. The McKetta Department of Chemical Engineering at the University of Texas at Austin seeks outstanding applicants for tenure-track faculty positions at the Assistant Professor level. A Ph.D. is required and applicants must have an outstanding record of research accomplishments and a strong interest in undergraduate and graduate teaching. There are two potential faculty positions available. For the first, researchers with interests in advanced materials for energy sciences, bioprocessing, or the discovery and delivery of therapeutics are encouraged to apply. For the second, researchers with interests in catalysis for energy storage and generation, sustainable chemical feedstocks and fuels, or materials for water purification are sought. Applications from women and minorities are especially encouraged. A successful candidate is expected to teach chemical engineering undergraduate and graduate courses, develop a leading sponsored research program, collaborate with other faculty, and participate actively in service to the university and the profession. Interested persons should submit in electronic form as a single PDF document a detailed curriculum vita including academic and professional experience, statements regarding their teaching philosophy and research plans, and a list of peer-reviewed publications and other technical papers. Applicants should also provide the names, addresses and telephone numbers of three or more references. The online application form can be found at **http://www.che.utexas.edu/facultyapplication**. Please apply by November 22, 2013, for primary consideration; however, the positions will remain open until filled. A security sensitive background check will be conducted on selected applicants. The University of Texas is an Equal Opportunity/Affirmative Action Employer.

CIVIL ENGINEERING

CIVIL ENGINEERING DEPARTMENT. The Civil Engineering Department in the College of Engineering at California State Polytechnic University, Pomona (Cal Poly Pomona) invites applications for one tenure-track position in civil engineering, preferably in the area of structural engineering, at the rank of Assistant Professor to begin fall 2014. For full position description and application procedures, please check the university website at www.csupomona.edu/ce or contact the Civil Engineering Department by email at **ce@csupomona.edu**. The University is an Equal Opportunity / Affirmative Action Employer.

DEPARTMENT HEAD

DEPARTMENT HEAD SEARCH. The College of Engineering at Kansas State University invites nominations and applications for the position of Head of the Department of Civil Engineering. The college seeks an individual with innovative leadership skills to strengthen successful instructional, research, and outreach programs in the department (see http://www.ce.ksu.edu). The successful applicant will help to implement the University Engineering Initiative Act to significantly increase the number of graduates from the college, and the university's visionary plan, K-State 2025, to be nationally recognized as a top 50 public research university. The department houses a University Transportation Center, operates a unique Civil Infrastructure Systems Laboratory, and participates in a university-wide water resources program with international collaborators. CE offers an ABET-accredited BS degree as well as MS and Ph.D. programs. Established programs of study and research include environmental engineering, geotechnical engineering, structural engineering, transportation/materials engineering, and water resources engineering. Candidates must have a doctoral degree in civil engineering or a closely related field. The successful candidate will have a strong record of scholarly and professional accomplishments meriting appointment as a full professor, leadership and administrative experience in an academic environment, a demonstrated commitment to diversity and excellent interpersonal skills. Nominations and inquiries may be directed to **Dr. J.H. Edgar at cesearch@ksu.edu**. Inquiries and applications will be confidential. The names and CVs of finalists will be publicly available. Screening of applications will begin on December 16th, 2013, and will continue until the position is filled. To apply, send a letter of application outlining qualifications for the position, a current curriculum vita, statement of vision and goals for leadership of the department, and the contact information of at least three professional references electronically in PDF format to: **cesearch@ksu.edu**. In accordance with Kansas Board of Regents policy, a successful pre-employment background check is required for the final candidate. Kansas State University is AA/EEO and actively seeks diversity among its employees.

ENGINEERING AND COMPUTING

SEYMOUR AND ESTHER PADNOS COLLEGE OF ENGINEERING AND COMPUTING, THREE TENURE-TRACK ASSISTANT/ASSOCIATE PROFESSORS. The School of Engineering within Grand Valley State University's Seymour and Esther Padnos College of Engineering and Computing invites applications for three tenure-track faculty positions at the Assistant/Associate Professor level. These positions have been established to

support our engineering programs, particularly, but not limited to, our foundational freshman and sophomore engineering courses. The start date for these positions is fall 2014.

The positions will foster the continued growth of GVSU's engineering programs, which lead to the Bachelor of Science in engineering (BSE) and Master of Science in engineering (MSE) degrees. The BSE program consists of project intensive ABET-accredited majors in computer, electrical, interdisciplinary, mechanical, and product design and manufacturing engineering, with mandatory co-op education experiences. The MSE program in analogous fields emphasizes professional practice as well as applied research. Sponsored by the local industry, these programs yield job-ready, as well as graduate-school ready, engineering graduates in support of the diversified regional industries. Of late, GVSU's engineering programs were recognized as exemplars of real-world engineering education in the U.S. by the National Academy of Engineering and nationally ranked by US News &World Report. All of our engineering programs are supported by industrial-grade laboratories, machine shops, and equipment in over 80,000 square feet of state-of-the art facilities in the Kennedy Hall of Engineering and the Keller Engineering Laboratories. Applicants must have a doctorate in an engineering discipline or a closely related field. Of particular interest is teaching experience in integrated freshman engineering programs and foundational freshman and sophomore engineering courses. Whereas our focus for these positions lies in our foundational courses, we also seek expertise to support upper division courses in EITHER one or more of the following: CAD/CAM, engineering data analysis, engineering mechanics, machine design, or dynamic systems OR one or more of the following: embedded systems, alternative energy systems, or wireless systems. All candidates must be committed to the highest quality of laboratory and project-based teaching, with excellent verbal and written communication skills, as well as scholarly and professional development. Preference will be given to candidates with industrial and/or project-based experience in addition to teaching experience. Professional licensure, the ability to teach broadly in one's field and an interest in general curriculum development are desired. An ability to participate in and capitalize upon existing collaborations with our west Michigan industrial partners and a history of external funding are highly valued.

These positions involve teaching in our undergraduate and graduate engineering programs, professional service and professional development. The successful applicants will support our BSE and MSE programs primarily through teaching, curriculum as well as course development, and professional development activities including scholarship. These applicants will support our co-op education and project-based teaching process as well as industrial collaborations and programs to meet the needs of industry. Engineering enrollment, currently at over 1,050 students, has experienced consistent growth that is expected to continue. Application review will begin immediately and continue until the position is filled. Detailed information and the on-line application process are available at **www.gvsujobs.org**. Include a letter of interest, curriculum vitae, statement of teaching philosophy, and at least three references listed by name, address, phone and e-mail address. Should you have questions or need other assistance, please call human resources at 616-331-2215. Grand Valley State University is an affirmative action, equal opportunity institution.

VirginiaTech
Invent the Future

Faculty Positions (2)
Department of Engineering Education

The Department of Engineering Education (EngE) at Virginia Tech invites applications for two faculty positions and welcomes applicants across ranks. Candidates must hold a doctorate in engineering education, engineering, education, or a related field; at least one degree (BS, MS, PhD) in engineering is desirable.

Successful candidates will demonstrate the ability to conduct basic or applied research in engineering education, as well as a strong commitment to undergraduate and graduate teaching. We welcome applicants with expertise across a wide range of engineering education areas and methods, including, but not limited to, quantitative research methodologies, learning analytics, technology in education, and the learning sciences. Experience in industry is also welcome.

Applications must be submitted online to **https://jobs.vt.edu** (posting number TR0130102). Review of applications will begin November 30, 2013. Applications should include: (i) a curriculum vitae, (ii) a 2 page research statement describing current research and future plans, (iii) a 2 page teaching statement, and (iv) names and contact information for three references. Details on how to prepare and submit all materials can found under "Posting Details" for this position on the website. Inquiries about the position should be directed to **Chair, EngE Search Committee, 660 McBryde Hall, MC 0218, Blacksburg, VA 24061, enge_search@vt.edu**

A more detailed description of the position and information about the Department of Engineering Education can be found at **http://www.enge.vt.edu/**

An EO/AA employer committed to diversity.

ENGINEERING EDUCATION

PURDUE UNIVERSITY, THREE TENURE-TRACK POSITIONS IN ENGINEERING EDUCATION. The School of Engineering Education (ENE) (https://engineering.purdue.edu/ENE) within the College of Engineering invites applications for three full-time, tenure-track positions at the rank of assistant or associate professor. Applicants should hold an earned doctorate in engineering or education or related discipline and at least one degree in engineering with expertise in engineering education research. Commensurate with the rank, we seek individuals who have either established themselves in a field of research congruent with the mission and goals of the school or have demonstrated the potential to do so. Successful candidates will have a demonstrated commitment to diversity, collegiality, and interdisciplinarity. They will be expected to teach in our undergraduate programs, including first-year engineering, and our graduate program, and develop a nationally recognized externally funded research program in engineering education. A background check is required for employment and applications must be submitted online: **https://engineering.purdue.edu/Engr/InfoFor/Employment**. Review of applications will begin 11/4/13 and will continue until filled. For questions regarding the application process, contact Marion Ragland, Faculty Recruitment Coordinator, College of Engineering (ragland@purdue.edu). Questions regarding the position should be addressed to Professor David Radcliffe (dradcliffe@purdue.edu). Purdue University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce.

PROFESSORSHIP

ENGINEERING EDUCATION (CONT'D)

PURDUE UNIVERSITY CROWLEY FAMILY PROFESSORSHIP IN ENGINEERING EDUCATION. The School of Engineering Education (ENE) (https://engineering.purdue.edu/ENE) within the College of Engineering invites applications for the Crowley Family Professorship in Engineering Education. Applicants should hold an earned doctorate in engineering or education or related discipline and at least one degree in engineering with expertise in engineering education research and be qualified for tenure as a full professor in engineering. We seek individuals with an outstanding record of achievement who can provide leadership in discovery, learning, and engagement based on a clearly articulated vision of the current needs and future directions of engineering education. Successful candidates will have a demonstrated commitment to diversity, collegiality, and interdisciplinarity, excellent communication skills, be expected to teach in both undergraduate and graduate programs, and develop a nationally recognized, externally funded research program in engineering education. A background check is required for employment and applications must be submitted online: **https://engineering.purdue.edu/Engr/InfoFor/Employment**. Review of applications will begin on November 4, 2013, and continue until successful candidate is identified. For questions regarding the application process, contact Marion Ragland, Faculty Recruitment Coordinator, College of Engineering (ragland@purdue.edu). Questions regarding the position should be addressed to Professor David Radcliffe, (dradcliffe@purdue.edu). Purdue University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce.

ENGINEERING EDUCATION (CONT'D)

PURDUE UNIVERSITY DALE AND SUZI GALLAGHER PROFESSORSHIP IN ENGINEERING EDUCATION. The School of Engineering Education (ENE) (https://engineering.purdue.edu/ENE) within the College of Engineering invites applications for the Dale and Suzi Gallagher Professorship in Engineering Education. Applicants should hold an earned doctorate in engineering or education or related discipline and at least one degree in engineering with expertise in engineering education research and be qualified for tenure as a full professor in engineering. We seek individuals with an outstanding record of achievement who can provide leadership in discovery, learning, and engagement based on a clearly articulated vision of the current needs and future directions of engineering education. Successful candidates will have a demonstrated commitment to diversity, collegiality, and interdisciplinarity, excellent communication skills, be expected to teach in both undergraduate and graduate programs, and develop a nationally recognized, externally funded research program in engineering education. A background check is required for employment and applications must be submitted online: **https://engineering.purdue.edu/Engr/InfoFor/Employment**. Review of applications will begin on 11/4/13 and continue until successful candidate is identified. For questions regarding the application process, contact Marion Ragland, Faculty Recruitment Coordinator, College of Engineering (ragland@purdue.edu). Questions regarding the position should be addressed to Professor David Radcliffe, (dradcliffe@purdue.edu). Purdue University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce.

PROGRAM SPECIALIST

ENGINEERING TECHNOLOGY

PROGRAM SPECIALIST. The Department of Engineering Technology and Surveying Engineering at New Mexico State University has an opening for a Program Specialist to be filled starting at the end of the fall 2013 semester. An earned bachelor's degree in an appropriate discipline and relevant knowledge and experience in international academics, cultural exchange, and communications, as well as excellent written and verbal communication skills are required. Preferred qualifications include an earned Master's degree and knowledge on project financing, international delegation, and technical training management. Responsibilities include: project financing and management, promoting academic, technological and cultural exchange between NMSU and institutes in China and other foreign countries; developing strategies for international outreach; and providing consulting to international students and their parents and to NMSU students on studying abroad and other opportunities. Interested candidates are requested to submit a letter of interest and a detailed CV. Email the materials to **Dr. Jeffrey Beasley at jbeasley@nmsu.edu with the words "International Specialist Search" in the subject line**. Review of applications begins November 11, 2013. Applications received after this date may be considered. Salary is commensurate with education and experience. Position is contingent upon funding. NMSU is an equal opportunity/affirmative action employer. Women and minorities are strongly encouraged to apply. Offer of employment is contingent upon verification of individual's eligibility for employment in the United States.

FRESNO STATE
Discovery. Diversity. Distinction.

Geotechnical Engineering
Assistant Professor - Academic Year
(Tenure-Track)

Teach a variety of undergraduate and graduate lecture and laboratory courses in Soil Mechanics and Geotechnical Engineering, conduct scholarly and applied research, and engage in service-related activities. Expected to teach other related Civil Engineering and laboratory courses, develop research in specialized areas, and incorporate current technology in course work as appropriate. Specific assignments will depend on department needs. Faculty may be called upon to teach in a distance education mode and will be encouraged to develop web-enhanced and/ or web-based instruction.

Submit materials by 11/15/13.

For more information and to apply, visit:
http://apptrkr.com/395964

Equal Opportunity Employer

INDUSTRIAL AND SYSTEMS ENGINEERING

VIRGINIA TECH: GRADO DEPARTMENT OF INDUSTRIAL & SYSTEMS ENGINEERING FOUR (4) ISE FACULTY POSITION ANNOUNCEMENTS. The Grado Department of Industrial and Systems Engineering at Virginia Tech in Blacksburg, Virginia invites applications for several tenure-track positions starting in the 2014-2015 academic year. Mathematical Optimization in Operations Research: Appointment at all lev-

els (**Posting No. TR0130077**): We seek an outstanding individual to help lead our instructional and research efforts in mathematical optimization and particularly seek individuals with expertise in the theory and methodology of optimization. For particularly well-established Full Professor candidates, an endowed professorship may be available. This position requires a Ph.D. with at least one degree in industrial engineering or a closely-related discipline. Human Factors Engineering and Ergonomics: Assistant or Associate Professor level (**Posting No. TR0130090**): specializing in cognitive ergonomics, cognitive engineering, and/or safety engineering. Preference is for individuals who have applied expertise within the area of systems design and/or evaluation, and an ability/interest to teach relevant curricula. This position requires a Ph.D. with at least one degree in human factors engineering, ergonomics, industrial engineering, or a closely-related discipline. Simulation Analysis in Operations Research: Assistant or Associate Professor level (**Posting No. TR0130076**): We seek an outstanding individual to help lead our instructional and research efforts in simulation analysis and particularly seek individuals with expertise in simulation methodology such as simulation optimization or stochastic optimization. This position requires a Ph.D. with at least one degree in industrial engineering or a closely-related discipline. Advanced Manufacturing Systems and Technologies: Assistant Professor level (**Posting No. TR0130111**): The successful applicant will be expected to take a leading role working with the Commonwealth Center for Advanced Manufacturing, a new research center developed in conjunction with Rolls-Royce, the Commonwealth of Virginia, university partners around the state, and several other member companies. This position requires a Ph.D. with at least one degree in industrial engineering or a closely-related field. Applicants should have achieved or show potential to develop a strong program of externally funded research and scholarship. The successful applicants will also be expected to provide skilled teaching of foundational and advanced courses at both the undergraduate and graduate levels. Applications should be submitted online to **jobs.vt.edu** and include a cover letter, current vita, research statement, teaching statement, up to three relevant research publications and the names of three references providing recommendation letters (submitted separately by the references to ise-search@vt.edu). Details on how to prepare and submit all materials can be found under "Posting Details" for these positions on the website. Review of applications will begin on January 3, 2014, and applications submitted after this date may not be considered. Virginia Tech has a strong commitment to the principle of diversity and inclusive excellence, and in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. Virginia Tech is the recipient of a National Science Foundation ADVANCE Institutional Transformation Award to increase the participation of women in academic science and engineering careers.

MANAGEMENT POSITIONS

THE UNIVERSITY OF NORTH TEXAS COLLEGE OF ENGINEERING ASSOCIATE DEAN FOR ASSESSMENT AND ACCREDITATION. The College of Engineering at the University of North Texas (UNT) is seeking candidates for the position of Associate Dean for Assessment and Accreditation beginning August 15, 2014. The Associate Dean for Assessment and Accreditation will develop solutions to support the college educational mission, assist in professional faculty development, establish and enforce college-wide policies, and direct the assessment activities across the College of Engineering for the purposes of program development and evaluation, accreditation, and institutional effectiveness. In collaboration with the dean, other associate deans, and department chairs, this person will implement the educational strategic plan of the college, the college policies, and the assessment and accreditation plan for the college. Further, she/he will coordinate all accreditation activities, policies, and procedures including Academic Program Assessment Reviews, manage the design and implementation of systems for collecting, analyzing, and reporting data related to accreditation by ABET, SACS, NSA, FAA, and other relevant agencies, work with faculty to develop and implement assessment methods including but not limited to, development and validation of rubrics and reports, oversee the implementation and use of assessment surveys, and work closely with faculty to develop and implement college-wide policies and procedures including ones for faculty development and success. The Associate Dean for Assessment and Accreditation of the College of Engineering reports to the dean of the college and holds a 12-month senior administrative appointment. The College of Engineering is home to over 2,500 bachelor's students, more than 330 Master's students and about 150 Ph.D. students. Additional information about the college is available at the college's website at engineering.unt.edu. Qualifications: Candidates must possess an earned doctorate in an engineering discipline represented in any department of the College of Engineering at UNT; an exemplary record of scholarly accomplishment that merits tenure at the rank of full professor in an appropriate department; demonstrated ability to work with faculty; previous administrative experience at the level of department chair/head or higher; a demonstrated commitment to diversity; and excellent communication skills. Preference will be given to candidates with previous experience with assessment and accreditation, with policy creation, or with professional faculty development. To Apply: All applicants must apply online to **https://facultyjobs.unt.edu** by submitting a resume, a letter of application indicating interest in and qualifications for the position, and the names and contact information of three references. Submit nominations and questions regarding the position to Dr. Costas Tsatsoulis (**tsatsoul@unt.edu**). Application deadline: The committee will begin its review of applications on December 1, 2013, and continue to accept and review applications until the positions are closed. The university: A student-focused public research university, UNT is the nation's 25th largest public university and the largest, most comprehensive in the Dallas-Fort Worth area. It is dedicated to providing an excellent educational experience to its 36,000 students while powering the North Texas region through innovative education and research. UNT's ultimate mission is to give a green light to greatness by helping its students, region, state and nation excel. The University of North Texas is an AA/ADA/EOE committed to diversity in its educational programs.

MECHANICAL ENGINEERING

MECHANICAL ENGINEERING FACULTY OPPORTUNITIES. The School of Mechanical Engineering at Purdue University has multiple openings for exceptional faculty candidates at all levels, and in traditional as well as emerging areas. This aggressive hiring program is to substantially grow the school and enhance its impact in research, education, and engagement. Applications are invited for tenure-track positions. Exceptional applicants in all specializations relevant to mechanical engineering will receive serious consideration. The focus is on expertise that includes: A1) Computational techniques for validated product/process simulation and optimization including multiscale modeling, sensitivity analysis, and uncertainty quantification for risk-informed decision-making; A2) Advanced manufacturing, including advanced materials processing, scalable nanomanufacturing, and intelligent process sensing and control; B1) State-of-the-art computational techniques for thermo-fluid processes and systems in general, and those related to biomedical, turbomachinery, or propulsion applications; and B2) Energy technologies including renewable and sustainable energy systems, advanced power generation systems, and high-performance buildings. The search also will emphasize cross-cutting expertise in the process-structure-property-function paradigm, including variabilities and uncertainties in data-rich problems, particularly as applied to areas of existing departmental emphasis including acoustics, design, manufacturing, energy, and thermo-fluid transport. Candidates should hold a Ph.D. in mechanical engineering or a related field and have a distinguished academic record. The successful candidate will develop world-class research programs and will teach both undergraduate and graduate students. Candidates at the assistant/associate professor level are targeted, but exceptional candidates at full rank will receive serious consideration. All applications should be submitted through a single College of Engineering-wide web portal. For consideration, please complete the online form at **https://engineering.purdue.edu/Engr/AboutUs/Employment/Applications**, and submit in electronic form a curriculum vita, statement of research and teaching interests, and the names and contact information for at least four (six for appointment at Associate or higher level) references. If you have difficulty submitting an application to this website, please contact Ms. Marion Ragland at: ragland@purdue.edu. Review of applications will begin November 1, 2013, and will continue until the positions are filled. A background check will be required for employment in this position. Established in 1882, the School of Mechanical Engineering is the oldest of Purdue's engineering schools

and has granted over 26,500 degrees. Through its past two centuries, the school has become synonymous with innovation and outstanding accomplishment in engineering research, education, and global engagement. Its students and faculty form a vibrant community of scholars who are recognized worldwide for their technical expertise and professional impact. In addition to supporting faculty expansion, the school's fundraising has enabled: growth in endowed professorships, with 18 now committed; the newly opened LEED-certified $34.5 million Roger B. Gatewood Wing of Mechanical Engineering, with substantial space dedicated to design research and education; $30 million expansion of the Ray W. Herrick Laboratories; plans for expansion of facilities in Maurice J. Zucrow Laboratories; numerous endowed scholarships and fellowships; and various innovative programs including global engineering and entrepreneurship. Its annual research expenditures and endowment/trust funds have grown rapidly to $22 million per year and over $80 million, respectively. Purdue University is located in West Lafayette, a welcoming and diverse community with a wide variety of cultures, excellent schools, plus ready accessibility to large metropolitan areas (the university is within two hours of downtown Chicago and within one hour of downtown Indianapolis). Purdue University is an equal opportunity/equal access/affirmative action employer fully committed to achieving a diverse workforce.

MECHANICAL ENGINEERING (CONT'D)

KENNINGER PROFESSORSHIP IN RENEWABLE ENERGY AND POWER SYSTEMS. THE SCHOOL OF MECHANICAL ENGINEERING AT PURDUE UNIVERSITY IS CONDUCTING a search for an academic leader to be the Kenninger Professor in Renewable Energy and Power Systems in Mechanical Engineering. S/he will be expected to serve as the focal point for the school's efforts to chart a course for continued leadership in education and research in partnership with the campus-wide energy research community, including that within the College of Engineering, in other colleges and in Purdue's various interdisciplinary centers in Discovery Park. The Kenninger Professorship is an integral part of a significant effort to develop Purdue's leadership in sustainable and environmentally friendly energy. The exploration of renewable energy sources such as solar, wind, and bio, energy transformation devices such as fuel cells and digital prime-movers, as well as the rapidly improving storage means such as hydro, flywheels and batteries, and technologies for their integration into a modern grid-infrastructure will all be important. The candidate should possess an outstanding track record and have led/established a notable research program at one of the world's leading universities or research organizations with a demonstrated capacity for effective development and management of research programs and the administrative structures required to support them. Substantially equivalent government or corporate research experience will also be considered. An earned doctorate in mechanical engineering or a related field is required. The successful candidate will develop a world-class research program, will teach both undergraduate and graduate students, and will function as a leader and mentor in a collegial environment which has a long tradition of excellence. Established in 1882, the School of Mechanical Engineering is the oldest of Purdue's engineering schools and has granted over 28,000 degrees. Through its past two centuries, the school has become synonymous with innovation and outstanding accomplishment in engineering research and education. Its students and faculty form a vibrant community of scholars who are recognized worldwide for their technical expertise and the impact of their work. In addition to supporting faculty expansion, the school's fundraising has enabled: growth in endowed professorships; the $34.5 million LEED-certified Roger B. Gatewood Wing of Mechanical Engineering; the $30 million Phase-I expansion of the Ray W. Herrick Laboratories; numerous endowed scholarships and fellowships; and various innovative programs including global engineering. Its annual research expenditures and endowment/trust funds have grown rapidly to about $22 million per year and over $80 million, respectively. Review of applications will begin October 14, 2013, and continue until a successful candidate is identified. Interested persons are requested to submit an application online at **https://engineering.purdue.edu/Engr/AboutUs/Employment/Applications**. The submitted material should include a letter of application emphasizing their ability to carry out the responsibilities of the position as described above; a complete curriculum vita; and names, addresses, and telephone numbers for at least four references. For questions regarding the application process, please contact Marion Ragland (ragland@purdue.edu). Nominations of outstanding potential candidates are very much welcome. Nominations and inquiries should be addressed to: Professor Jay Gore Search Committee Chair, gore@purdue.edu. A background check is required for employment in this position. Purdue is an Equal Opportunity/Equal Access/Affirmative Action employer fully committed to achieving a diverse workforce.

MECHANICAL ENGINEERING (CONT'D)

ROSE-HULMAN INSTITUTE OF TECHNOLOGY'S MECHANICAL ENGINEERING DEPARTMENT, A RECOGNIZED LEADER IN UNDERGRADUATE ENGINEERING EDUCATION, INVITES applications for a tenure-track position beginning fall 2014. The targeted area of specialization is in mechanics at the level of assistant professor. However, exceptional applicants in any area of specialization and at all levels will be considered. Applicants must have a strong commitment to undergraduate engineering education, including a passion for classroom teaching and laboratory instruction, and a commitment to life-long personal and professional development. An earned or near-complete Ph.D. is required. A B.S. degree in mechanical engineering and industrial experience are desirable. Essential job functions include: classroom teaching and student advising; curriculum development and improvement; and service and committee work. For full consideration please apply on-line at: **https://jobs.rose-hulman.edu**. Additional information is available at: www.rose-hulman.edu/me/. Screening will begin November 30, 2013. EEO/AA.

MECHANICAL AND MANUFACTURING ENGINEERING

MIAMI UNIVERSITY - OXFORD, OHIO. DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING. THE DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING AT MIAMI UNIVERSITY (OXFORD, OH) SEEKS applicants for a tenure-track Assistant/Associate Professor position in the thermal fluid sciences beginning fall 2014. Miami University, located 35 miles north of Cincinnati, has 15,000 undergraduate and 2,400 graduate students. U.S. News &World Report has ranked Miami third in the nation for "Best Undergraduate Teaching." SmartMoney has ranked Miami ninth nationally for return on investment among both public and private universities. Miami is recognized as a top value in higher education by Forbes magazine and was included in Kiplinger's annual list of the "100 Best Values in Public Colleges." The position requires a Ph.D. in mechanical engineering or a closely-related field with research experience in thermal or fluid systems or energy conversion. ABDs will be accepted, but the doctorate must be completed by the time of appointment. Desired qualifications include: teaching or industrial experience in one or more of the fields of heat transfer, fluid mechanics, thermodynamics, computational fluid dynamics and energy conversion, and a record of grant funding and scholarly publications. To be appointed to the rank of associate professor, the successful candidate will have an established record of high quality teaching and scholarship/research, with scholarly publications and grants related to the thermal-fluid sciences. Send applications to: **Dr. Andrew Sommers, Screening Committee Chair,**

Department of Mechanical & Manufacturing Engineering (MSC 1078), Miami University, 56 Garland Hall, 650 E. High St., Oxford, OH 45056. Contact phone number is 513-529-0718. Electronic submissions may be sent to MMEDept@miamioh.edu. Applications should include a cover letter, curriculum vita, statement of teaching philosophy, statement of research experience and plans, and three letters of recommendation. Screening of applicants begins November 15, 2013, and will continue until the position is filled. Miami University is an EOE/AA employer with smoke- and tobacco-free campuses. Miami's Annual Security and Fire Safety Report with information on campus crime, fires, and safety may be found at: http://www.MiamiOH.edu/campus-safety/annual-report/index.html. Hard copy available upon request. Employment will require a criminal background check according to University guidelines.

MECHANICAL AND MATERIALS ENGINEERING

A non-tenure-track Faculty Position in Mechanical Engineering at the University of Rochester. The Edmund A. Hajim School of Engineering and Applied Sciences at the University of Rochester invites applications for a non-tenure-track, full-time faculty position in the Department of Mechanical Engineering. Applicants must be dedicated teachers with outstanding educational accomplishments in broad areas of mechanical engineering, including design and modern finite element methods with familiarity in solid and fluid mechanics, energy, and systems engineering. Preference will be given to applicants with a Ph.D. in mechanical engineering and demonstrated excellence in engineering education, whose teaching experience is in the area of both experimental and computational mechanical system design, especially precision engineering. The successful candidate will have the opportunity to develop groundbreaking new courses in mechanical design and precision engineering design. This faculty appointment is expected to participate heavily in departmental teaching, service, advising, and laboratory programs. The University of Rochester is embarking on new directions in the Hajim School of Engineering and Applied Science with targeted growth in areas related to mechanical engineering; The candidate should anticipate excellent interactions with the full time faculty, staff and undergraduate mechanical engineering students. The Hopeman Engineering building is located on River Campus, which offers an exceptionally rich environment for engineering, entrepreneurial, and basic science collaboration. Review of candidates will continue until the position is filled. Applicants should electronically send the following to **jmorris@me.rochester.edu**: a letter of transmittal and a CV with recent professional and teaching experiences; a statement of teaching interests and any supporting information that documents teaching experience and expertise; the names of at least two references who are familiar with your teaching experiences. The department is fully committed to increasing the diversity of the campus community and the curriculum. Candidates who can contribute to that goal are encouraged to apply and to identify their strengths and experiences in this area. The University of Rochester is an Equal Opportunity/Affirmative Action Employer.

KANSAS STATE UNIVERSITY | Mechanical and Nuclear Engineering

Endowed Chair
KANSAS STATE UNIVERSITY
Department Head

Kansas State University College of Engineering invites applications for the position of Department Head of Mechanical and Nuclear Engineering. The college seeks an individual who will provide innovative and energetic leadership needed to strengthen successful instructional, research, and outreach programs in the department (see http://www.mne.ksu.edu). The candidate must have earned a doctoral degree in mechanical or nuclear engineering or a closely related engineering field, a strong record of scholarly and/or professional accomplishments, and possess leadership, administrative, personnel management, budgeting, and communication skills. The candidate must be eligible for the rank of professor. The successful candidate will be appointed to the Theede Chair in Mechanical Engineering. To apply, send resume with cover letter to mne-dhsearch@k-state.edu. For more information, contact search committee chair Gurdip Singh, 785-532-7945 or gurdip@ksu.edu. For full position announcement, see http://www.mne.ksu.edu/positions.

MECHANICAL AND MATERIALS ENGINEERING (CONT'D)

School of Mechanical and Materials Engineering, Washington State University, Pullman, WA. The School of Mechanical and Materials Engineering (MME) at Washington State University (WSU) invites applications for multiple full-time tenure-track or tenured faculty positions in the mechanical engineering (ME) or materials science &engineering (MSE) programs. The successful candidate will be expected to teach undergraduate and graduate courses in ME or MSE, mentor diverse students, develop collaborative research, establish an externally funded research program, and publish scholarly work. Applications will be considered for positions at all ranks commensurate with qualifications. The school welcomes strong candidates who can complement and collaborate with existing research programs in the School, the College of Engineering & Architecture, and industries in Washington including aerospace, advanced manufacturing and materials, and renewable energy. Candidates with strong research and teaching interests in (a) advanced manufacturing processes, (b) aerospace dynamics and control, (c) renewable and clean energy, (d) advanced materials, (e) infrastructure materials, or (f) sustainable design are particularly encouraged to apply. The School of MME has 27 tenured or tenure-track faculty members, including nine fellows of professional societies, 1,000 undergraduate students, and 150 graduate students. The city of Pullman, nestled in the rolling wheat fields of southeastern Washington, offers small-town charm, low crime, and PAC-12 athletics. It was named by Bloomberg Business Week as the best place to raise your kids in Washington. Qualifications: earned doctoral degree in mechanical or materials engineering or a closely related field prior to the start of the appointment; demonstrated record of scholarly work and potential to establish a robust research program; demonstrated excellent verbal and written communication skills, and commitment to collaborate with diverse internal and external groups. Application: the search committee will accept applications until the positions are filled, with candidate screening beginning November 1, 2013. An application should include: a cover letter indicating field of interest including research and teaching; a curriculum vita; a statement of research plans (two pages); a statement of teaching experience and interests (two pages); and contact information for four references. The application must be submitted online at **www.wsujobs.com/applicants/Central?quickFind=59027**. WSU is an EO/AA Educator and Employer. For additional information on Washington State University and MME, visit our home page http://www.mme.wsu.edu/.

MULTIPLE ENGINEERING DISCIPLINES

Georgia Southern University's Department of Mechanical Engineering invites applications for four tenure-track positions: [1] Assistant Professor of Mechanical Engineering (Design for Manufacturing), [2] Assistant Professor of Mechanical Engineering (Manufacturing/Industrial Automation), [3] Assistant/Associate Professor of Mechanical Engineering (Bio-Mechatronics), and [4] Assistant/Associate Professor of Mechanical Engineering (Engine R&D). Each position requires teaching, research, and service responsibilities as well as a terminal degree. The full text advertisement, including information about the department, faculty, and the complete position announcement with all qualifications and application instructions, is available at **http://ceit.georgiasouthern.edu/facstaff/employment/**. Screening of applications begins November 25, 2013, and continues until the positions are filled. Georgia is an open records state. Georgia Southern is an AA/EO institution. Individuals who need reasonable accommodations under the ADA to participate in the search process should contact the Associate Provost.

MULTIPLE ENGINEERING DISCIPLINES (CONT'D)

Western Washington University is developing new programs in manufacturing engineering and plastics and composites engineering, and invites applications for multiple positions in both areas. WWU currently has highly regarded programs in manufacturing and plastics engineering technology that will be transitioned into these new engineering programs. We are looking for energetic individuals who will help us develop industry-ready graduates through a combination of creative problem-solving, analytical skills development, and experiential learning. This is a unique and exciting opportunity to be part of the foundational development of these programs, and to help build and strengthen connections to other areas such as with WWU's Advanced Materials Science and Engineering Center (AMSEC) and Institute for Energy Studies. See the full announcements and instructions at **http://www.etec.wwu.edu/engineering-jobs.html**. Review of applications will begin December 1, 2013, and will continue until the positions are filled. EO/AA.

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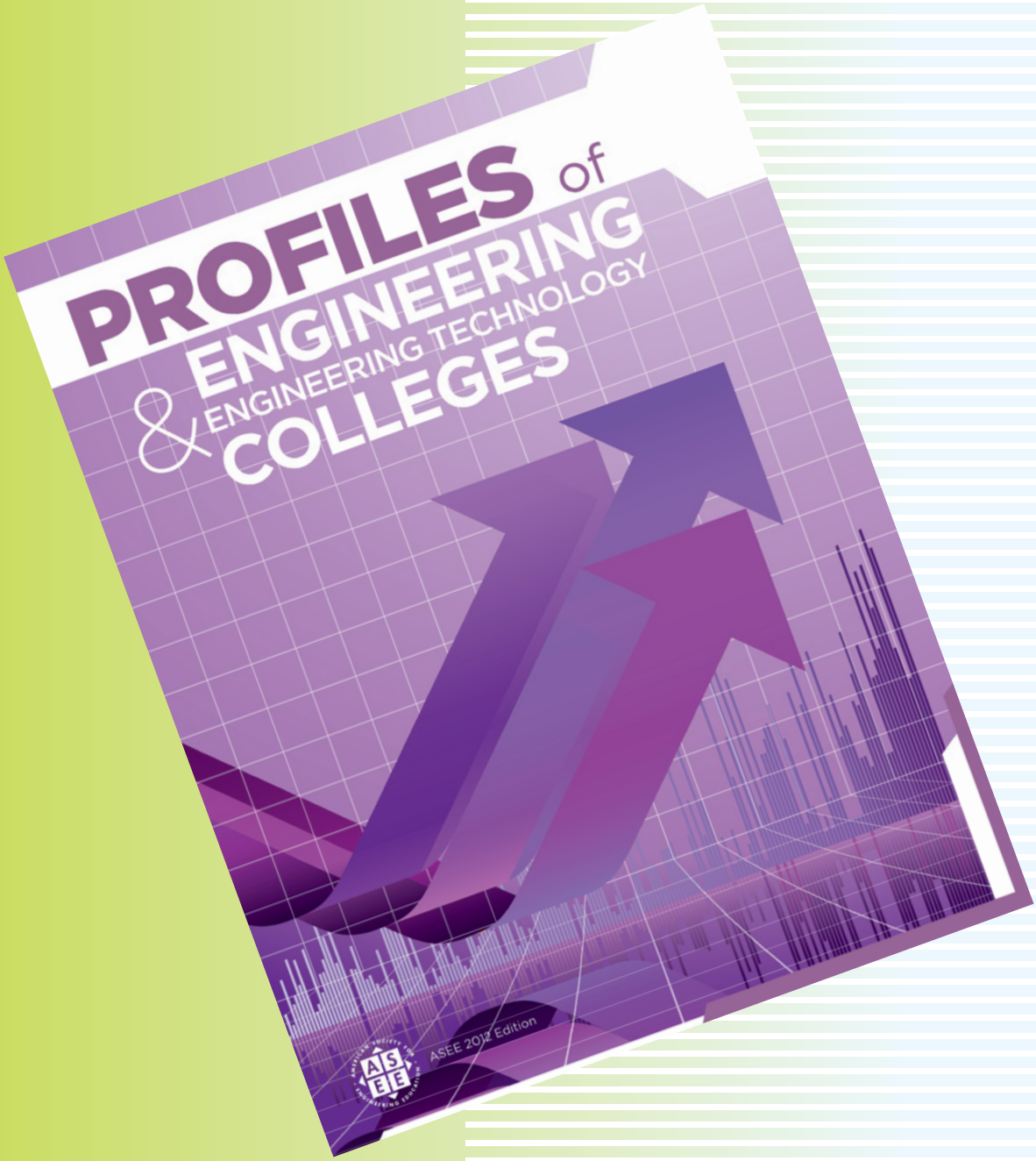
Find out more at
www.asee.org/ASEE-VCP

This project is partially supported by NSF grant DUE-1224217.



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Sustainability for Whom?

Students need to grasp the human-Earth connection.

Sustainability is all the rage these days, but what does the term really mean – and how should it be taught?

After decades of working to understand and apply the concept in engineering education, I've reached this simple definition: Sustainability means fulfilling human needs in harmony with the Earth. To be truly sustainable, design must put people on par with green technology.

My quest began in 1987 with publication of the World Commission on Environment and Development's Brundtland Report, Our Common Future. It defined sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

FULFILLMENT GOES WELL BEYOND THE BASICS OF FOOD, SHELTER, AND CLOTHING.

Like most of my engineering colleagues, my first response was to see sustainability as a challenge to reduce pollution and the use of vital resources by developing renewable substitutes. If we could stretch resources without producing more harmful substances than Earth could absorb, then human life could be sustained for a very long time. Our relationship with the planet's living and material systems would be in harmony.

So I continued to make buildings more efficient while using solar energy to provide heat, light, and electricity. From this green buildings work, I developed a first-year design project that guides students through a conceptual design of a net zero-energy home (NZEH).

Despite this technologically progressive attitude, I had a growing sense that a sustainable future required rethinking progress and our day-to-day lives. Consider housing. We now build homes that are better insulated, have lower air leakage, and are more efficiently heated and cooled than ever before. Yet they use record amounts of energy. Why? Because houses are bigger and there are more of them.

My eureka moment occurred when one of the first-year teams made a video emphasizing how redesign of technology like the NZEH can achieve sustainability without requiring any change in behavior or lifestyle. It broke my heart because I knew that attitude was unsustainable. And I had failed to help the students see that.

The belief that growth can go on forever prevents humans from ever being in harmony with Earth. Engineering educators must therefore look closer at the other aspect of sustainability – what it means to "meet needs."

Investigating needs is right up our alley. Our engineering codes of ethics guide us to hold paramount the public's health, safety, and welfare.

Scholarship in the area of needs has produced valuable insight that can help guide our work. Beyond Maslow's pioneering work in 1943, recent scholars have included David Braybrooke, *Meeting Needs,* 1987; Manfred Max-Neef, *Development and Human Needs,* 1989; and Martha Nussbaum, *Women and Human Development: The Capabilities Approach,* 2000. These scholars have shown that for people to lead fulfilling lives, they need much more than food, clothing, and shelter. Humans also require safety, affection, social interaction, expression, recreation, and a sense of belonging to something bigger than themselves. It takes all of that to sustain a healthy, life-supporting world.

This past spring, our client-driven first-year design project was to produce something to make Penn State more sustainable. While most teams focused on reducing resource use and waste via a new technology, one team developed a design that was not only more in harmony with Earth, it also facilitated the fulfillment of needs of students living in residence halls. Their design removed the mini-fridges and microwaves now crammed into each double-occupancy room and created a common space on each floor with two full-size refrigerators, two microwaves, a television, a sink, and a sitting area. Not only did their concept cut electricity use by about 90 percent, it also encouraged social interaction and sense of community. In fact, their project addressed and nurtured nearly every aspect of human fulfillment.

Think about what this team achieved. The students significantly pared the use of materials for appliances. They drastically reduced energy consumption. And they still paid attention to the needs of young people to socialize. Their sustainable structure should make residents' lives more fulfilling – by design.

Andy Lau is an associate professor of engineering at Penn State.

The Institution of Engineering and Technology

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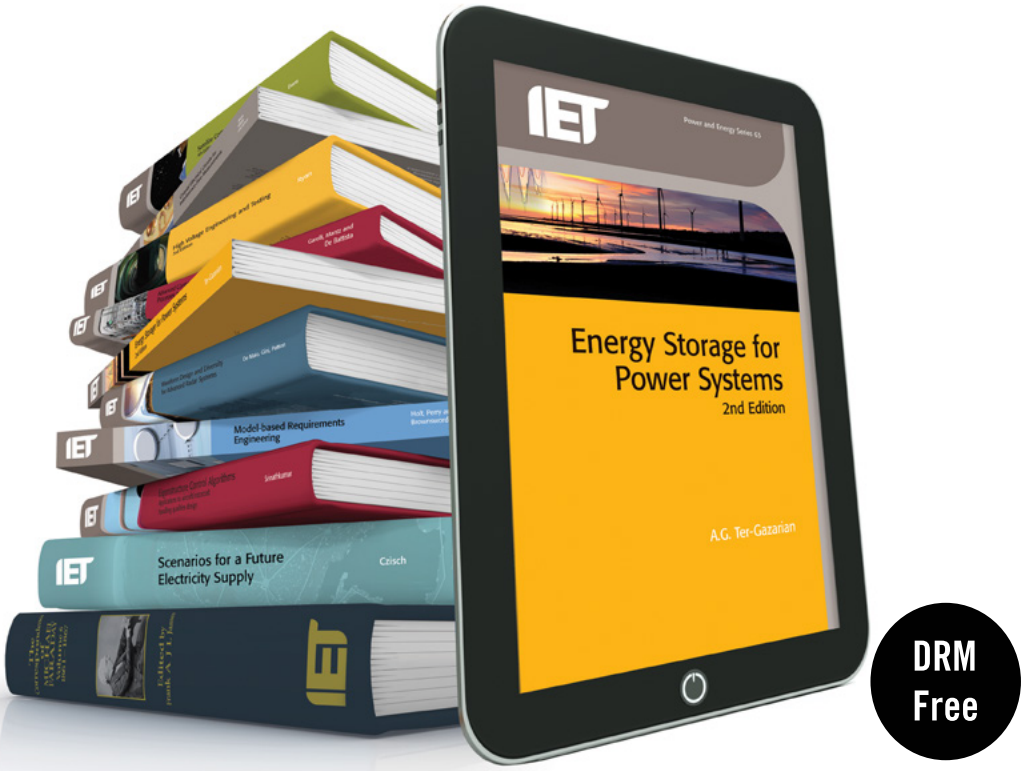

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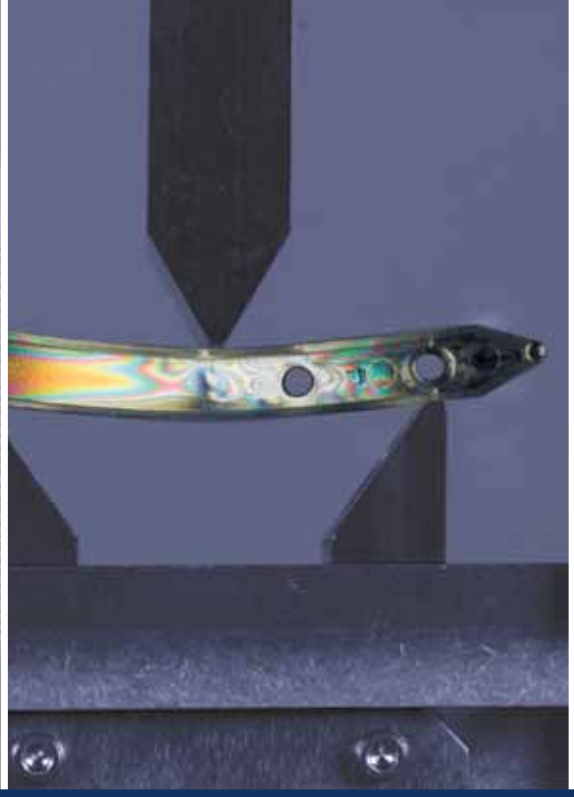

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