SPECIAL EDITION ISSUE

September 2017 • Issue #483

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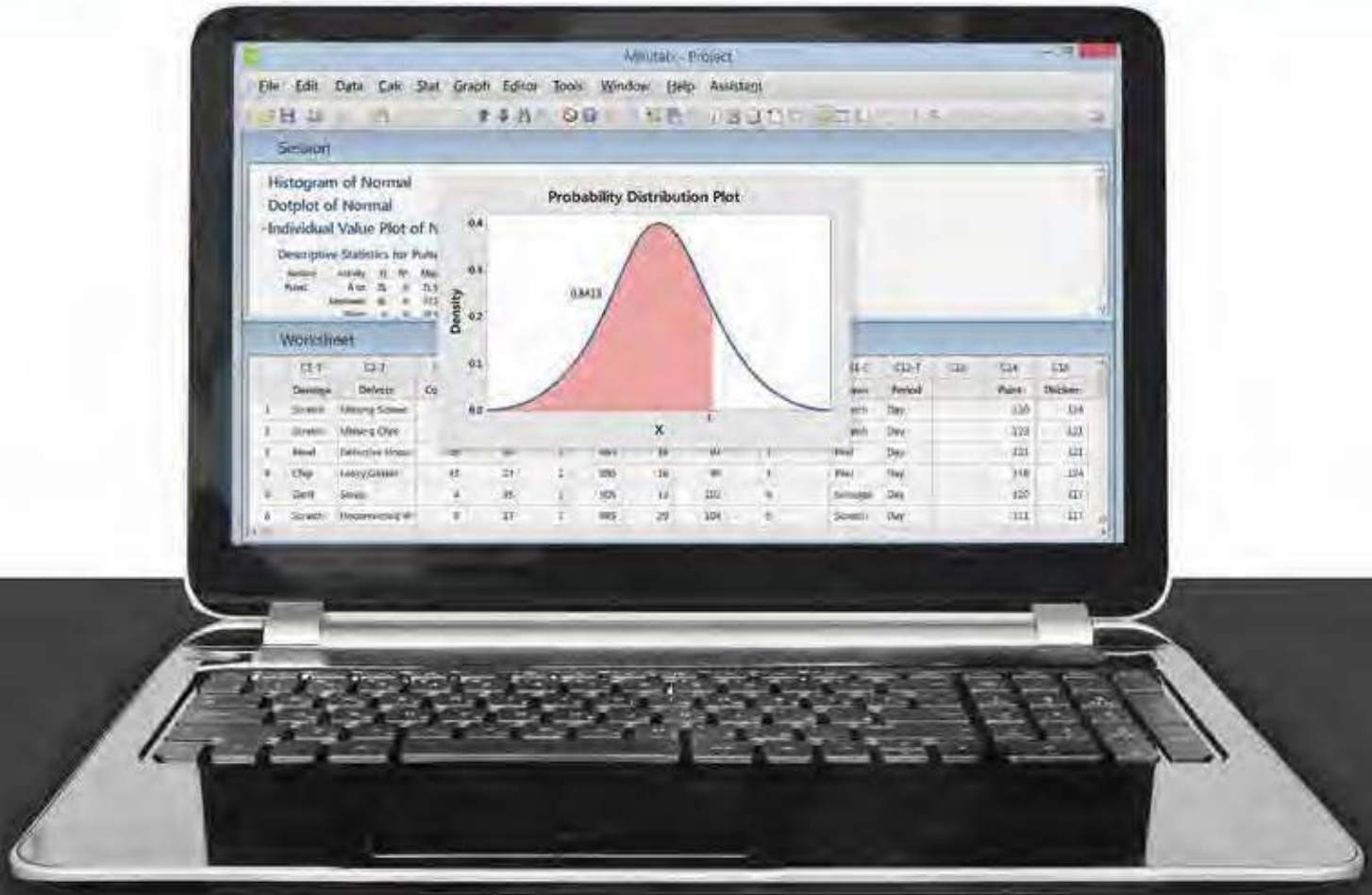

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AMSTATNEWS

SEPTEMBER 2017 • ISSUE #483

Amstat News welcomes news items and letters from readers on matters of interest to the association and the profession. Address correspondence to Managing Editor, *Amstat News,* American Statistical Association, 732 North Washington Street, Alexandria VA 22314-1943 USA, or email *amstat@amstat.org*. Items must be received by the first day of the preceding month to ensure appearance in the next issue (for example, June 1 for the July issue). Material can be sent as a Microsoft Word document, PDF, or within an email. Articles will be edited for space. Accompanying artwork will be accepted in graphics file formats only (.jpg, etc.), minimum 300 dpi. No material in WordPerfect will be accepted.

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The American Statistical Association is the world's largest community of statisticians. The ASA supports excellence in the development, application, and dissemination of statistical science through meetings, publications, membership services, education, accreditation, and advocacy. Our members serve in industry, government, and academia in more than 90 countries, advancing research and promoting sound statistical practice to inform public policy and improve human welfare.

influential educators

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statistical literacy

More Education Online

The following articles are also included in this special education issue. Read them online at *http://magazine.amstat.org*.

The Importance of Teaching Ethics in Statistical Consulting Courses—Alan C. Elliott shares ways to teach ethical guidelines and mentor students into a life-long practice of responsible scientific conduct.

Professional Development: What Does the ASA Offer?— Need help advancing your career? Find a professional development course for you.

Design and Implementation of Professional Development MOOCs for Statistics Teachers — Hollylynne Lee and Dalene Stangl share how two teams took on the challenge of designing and implementing two MOOCs that could assist teachers in teaching statistics.

Statistical Literacy and Journalism: The Road Less Traveled—Trevor Butterworth discusses Sense about Science and how to get journalists to "see" statistical concepts.

undergraduate statistics education

STATtr@k

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member news

Who Was Your Favorite Teacher and Why?

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A Tale of Two Conferences

ASA President Barry Nussbaum gives an invited presentation at the 61st International Statistical Institute's World Statistics Congress in Marrakech, Morocco, in mid-July.

It was the best of times.

In July, I had the opportunity to attend two major statistical conferences, and I realized their similarities and differences may provide some insight into the future of our profession.

In mid-July I was at the 61st International Statistical Institute's (ISI) World Statistics Congress. ISI 2017 was held in delightful, but hot, Marrakech, Morocco. At the end of July and into early August, it was off to Baltimore for our Joint Statistical Meetings.

For me, the first surprising revelation was that ISI actively seeks the support of the host country in planning and producing the conference. Morocco made a substantial monetary contribution to support the conference. At every room, was the reminder that this conference was "under the high patronage of his majesty King Mohammed VI." (Notice the king and I in the photo taken during my talk, above.)

ISI started with speeches from both the high commissioner of economy and finance and the high commissioner for planning of the Moroccan government. Notably, the ASA conducts JSM in the total opposite: an apolitical atmosphere. I find this a fascinating dichotomy … something to think about.

At the World Statistics Congress, Sir David Cox was honored by being awarded the first International Prize in Statistics. Our profession had noted for years that there was no major international award for statistics. But statistics has been in the limelight recently with the focus on Big Data, increased interest from young people, and a desire by statisticians to increase the public profile of our field. So the ASA—along with the International Biometric Society (IBS), Institute of Mathematical Statistics (IMS), ISI, and Royal Statistical Society (RSS)—teamed up to form the International Prize Foundation. I was honored to be on the stage for the presentation of this first prize.

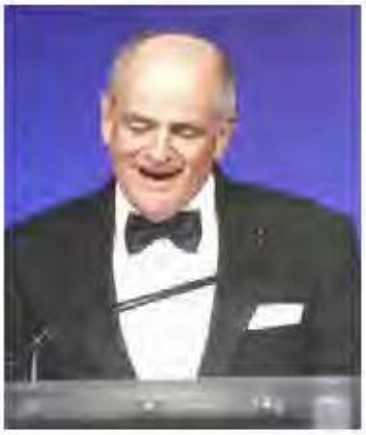
Pedro Silva, ISI president, welcomed the audience. Representing the ASA, I introduced the prize, followed by IBS President Elizabeth Thompson, who formally announced the winner. Then, Richard Davis, IMS president, presented the award to RSS President David Spiegelhalter, who accepted on behalf of Cox, who was unable to attend personally. However, Cox did express his thanks and gratitude in a video message.

Barry D. Nussbaum

Of course, I am quite grateful to the members of this prize foundation, chaired by Susan Ellenberg, for doing all the work.

So, did this result in the desired increased international recognition of statistics? It is too early to tell, but there is one concrete outcome to report. I was told coverage of the conference lasted at least five minutes on the local French-speaking television news. Unfortunately, the amount of French I understand is *seulement un petit peu*, so I did not just happen to view the French news. *C'est dommage*. By the way, French and Arabic are spoken in Morocco, and my understanding of Arabic is even less than French, so I really don't know if there was further coverage.

The ISI World Statistics Congress had approximately 2,000 attendees over a full week, with a collection of plenary and concurrent events, meetings, and social events. By my not very scientific survey-taking (pure observation at coffee breaks), the crowd seemed to represent mainly European statisticians, contrasting with the large number of Asian statisticians at JSM.



ASA President Barry Nussbaum delivers the president's address at this year's JSM in Baltimore.

Reflecting the current interest in Big Data, the ISI's presidential invited keynote speaker was Hadley Wickham, a legend in the R world, who spoke about data science in the tidyverse

Not surprisingly, in addition to being able to participate in the presentation of the International Prize, a highlight for me was to give a presentation at the invited session with statistical society presidents.

Silva chaired the session and invited Spiegelhalter and me. Spiegelhalter's talk was titled, "Statistics: A Front Line Weapon in the Fight Against Alternative Facts." Mine was titled, "The State of the Statistics Profession: It Was the Best of Times; It Is the Best of Times."

I can't hide the fact that it was quite a thrill sharing the podium with Spiegelhalter, a prominent statistician. How prominent? He is correctly addressed by adding the appellation "Sir" before his name.

Moving to this side of the Atlantic, I had the true pleasure of attending JSM. According to my best accounting, although I am not so good with numbers, this was my 25th JSM, dating back to 1992 in Boston. In fact, I am a believer that the *second* attendance at a JSM is what really counts, since it means we did something right and folks returned! For those of you who listened to my address this year, you may remember I singled out my second JSM, in which I was greeted by then ASA President Stu Hunter. Fittingly, a spry 94-year-old Hunter was in attendance this year, and was even the recipient of this year's ASA Mentoring Award. Congratulations, Dr. Hunter.

As an ASA officer, I had the opportunity to view JSM two distinct ways this year. The first concerns the inner workings of the ASA. With two days of board of directors meetings and a few more days of appearances at several governing board meetings, several workshops, several council meetings, several business meetings, several receptions, several chapter meetings, and several committee meetings, I saw first-hand how this society is run by the many members who give their time and effort to promote our organization and our profession. I also saw how the ASA staff works in collaboration to ensure a smoothly running conference. There are an incredible number of Ts to cross. My hat goes off to them.

I was able to welcome and thank the members of the Helen Walker Society who go that extra mile to further support ASA activities. And, yes, I gave the President's Address. That's me in the tuxedo.

Of course, the second view was to watch and participate in the many sessions and events in the convention center. It is a true joy for me to see 6,500 attendees running to catch sessions; sitting with colleagues, new friends, and collaborators; viewing publishers, recruiters, and vendors in the EXPO; and even waiting patiently in line at Starbucks.

During my presidential speech, I conveyed thoughts about Big Data and ASA initiatives. I will not repeat those here. (For those of you who just can't do without, both my talk and the excellent talk of my invited speaker, Jo Craven McGinty of *The Wall Street Journal*, will be available on the ASA website.) I recognize my talk was at the same time as an Orioles game across the street. Apparently, my talk was not broadcast on the jumbotron at the ball park … probably a technical glitch.

So what is my most salient memory from JSM? It is the *youthful enthusiasm* I witnessed. I want to point to four distinct occasions embedded in my mind.

First, I had the opportunity to welcome the first-time attendees at their orientation and reception Sunday afternoon. JSM had about 1,400 first-timers, and many of them streamed into that reception. It was quite a joy to see that much fresh interest. Please come back next year.

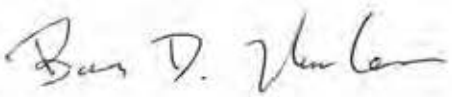
But there was more! At the JSM Opening Mixer, I was dazzled by the number of enthusiastic attendees and the upbeat spirit of camaraderie.

And there is still more! I addressed the student chapter meeting. Student chapters are growing at an explosive rate. This is an incredible reflection on the vibrancy of our profession today. Keep going, students.

The fourth occasion is my stop at the Statistics and the Environment Section meeting. Having spent 40 years at the US Environmental Protection Agency, this was the first section I joined, and I even served as its chair in 2000. So in a big sense, it was like going to my alumni reunion. The attendance was much higher than in my formative years. I do worry about the environment in today's climate. Seeing so many new faces there reassured me we are in good hands. Taken all together, this youthful enthusiasm assures me that …

It is the best of times.

Significantly forward,



Dennis K. Pearl

Director of the Consortium for the Advancement of Undergraduate Statistics Education

This interview with Dennis Pearl, conducted by **Allan Rossman** of Cal Poly, originally appeared in the *Journal of Statistics Education*, volume 25, issue 1. To read it in its entirety, visit *https://goo.gl/Mpq9Ca*.

Let's start with the 18-year-old version of you. Where were you then, and what were your thoughts about education and career goals at that point?

That would be 1969. I was a sophomore at Berkeley, protesting the Vietnam War and discovering I was no longer the smartest guy in the class like I was used to being in high school. I had a terrific AP calculus teacher in high school and figured I'd be a math major, go on to graduate school, and become a math professor. Unfortunately, I had a pretty boring instructor in my linear algebra class at Berkeley, and the same guy was going to teach the next course in the series, so I decided to shop for something else. My brother was a senior there and convinced me to take an introductory statistics class with him taught by Erich Lehmann. By the second week, I was hooked! My math classes were about understanding elegance, while statistics was about understanding evidence, and it just seemed the world needed more people who could do the latter.

At that point, I didn't think much about education, except noting which qualities I liked in an instructor and which I didn't. I liked organized professors like Lehmann, witty professors like Elizabeth Scott, professors who kept their class involved in discussions like David Freedman, professors who had the class construct their own knowledge like Jerzy Neyman, and friendly professors like Kjell Doksum. Then, there was David Blackwell, who was in a class by himself, as the quintessential explainer of complex things and who also had all of the traits mentioned above. The Berkeley Statistics Department had a lot of great teachers, and all of them gave me a feel for the relevance of the subject. I had the opposite feelings about the math instructors I encountered and so I became a statistics major.

What did you do after you earned your bachelor's degree, and how did you make that decision?

Oops—I only had Neyman as a grad student—but his teaching style was unique. He just stayed seated and asked random students to go to the board and work things out. If you were lost, he called on someone else—but after a few sessions, every student worked like crazy to be prepared!

At the end of spring quarter in 1971, I had the units to graduate and I had no doubt I was going to grad school in statistics—but felt like I needed to slow down and possibly take some time off (I had only just turned 20 years old.). So, I postponed my graduation until after fall quarter and luckily was selected to take part in a National Science Foundation (NSF)-supported research program organized by an engineering professor, which turned out to be a life-changing experience.

It involved eight senior undergrads: two from math, two from statistics, two from engineering, and two from ecology. Our task was to model fire and its effects. We had access to four farmers in California who were doing controlled burns on their property. The math students worked out differential equations on how the fire might spread; my teammate and I in statistics designed the experiments to collect data, and then worked to analyze it; the engineering students devised the instrumentation to measure stuff; and the ecology students made predictions about the effects on the non-plant organisms in the burn area.

At the end of the summer, I was picked to go to the national AAAS meetings in Philadelphia to present our findings, where I heard talks by Carl Sagan and met Margaret Mead. That summer, I stopped thinking about statistics as a branch of mathematics and realized that what I wanted in life was a career as a statistical scientist, with the emphasis on science.

In my final quarter as an undergrad (fall 1971), I asked David Blackwell if he would supervise me in a reading course to attempt to model the spread of fire using ideas from game theory, so I was able to continue that experience with my teaching idol. From January until grad school started for me in September 1972, I spent a little time working to have enough money to travel around Europe, and I met my wife in Jerusalem (so my second life-changing experience in one year).

Dennis Pearl is professor of statistics at The Pennsylvania State University and director of the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE). He is a fellow of the American Statistical Association.

This interview took place via email November 18–29, 2016. To read it in its entirety, visit *https://goo.gl/Mpq9Ca*.

Dennis Pearl (right), director of CAUSE, presents the CAUSE Lifetime Achievement Award to Christine Franklin of the University of Georgia.

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You stayed at Berkeley for graduate school, right? Did you consider going elsewhere?
Yes—I stayed in Berkeley for another 10 years and never considered anyplace else for grad school. I was a TA [teacher's assistant] for Freedman, [Robert] Pisani, and [Roger] Purves (2007) as they wrote their classic introductory text. I became involved in studies of molecular evolution when the field was just new. I worked on a congressionally mandated study of the effects of ozone depletion on human health (my dissertation was about a stochastic model of skin cancer), on studies of law school admission policies toward women and minorities, and on studies of the workings of the subconscious brain.

ResearchGate.net tells me I'm at about 7,500 citations now, and probably a good quarter of them came from my work as a grad student. So things were pretty interesting in my teaching, research, and collaborative work, while—during those years—our three children were born and my wife and I were reasonably active politically. I guess I slowed down to averaging perhaps a little under one life-changing event per year!

Was teaching a strong interest of yours at that point or just something you had to do in addition to your research? Did you have opinions about the FPP text/course then; did you have input into its development?
Well, I loved teaching and wanted to be better at it, but I wasn't really thinking systematically about it. We would have weekly TA meetings and Freedman, Pisani, and Purves—but especially Freedman—would talk about the big ideas of the week and tell us how to remove the mathematics and just relay the core concepts of the discipline in English. I participated in the discussions, but I was just learning from them and not really contributing. After I taught the class once, I started speaking up more—about the details of the logistics of running the recitation sessions—to let the new TAs know what seemed to be working for me. It wasn't really until I got to Ohio State and was coordinating TAs of my own that I started to take a more scholarly approach to teaching.

Consortium for the Advancement of Undergraduate Statistics Education (CAUSE)

I'd like to ask directly about a topic we've skirted thus far: your serving as director of the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE), *www.CAUSEweb.org*. How did you come to take on this role, and what appealed to you about it? (I suspect readers are expecting to see "this was another Dick Scheaffer project" in your response.)
Actually, it was Joan Garfield and Deb Rumsey who received funding from the ASA (but that was when Dick Scheaffer was ASA president, so the theme continues!) to hold a series of meetings about starting some kind of national undergraduate statistics education effort. We decided on a basic structure, with a director overseeing the organization and three sub-components (research, professional development, and resources), each supervised by separate associate directors. Deb was going to be the director, Joan would be the associate director for research, and Beth Chance and you [Allan Rossman] would share the role as associate director for professional development. Also, we hadn't settled on an associate director for resources, though Jackie Dietz (who had just finished her successful stint as founding editor of the *JSE*) was considering taking on the job. As things turned out, Deb had a new baby and Jackie declined, so new team members were needed for those responsibilities. Joan called and asked if I would take on the role of director, since I had been active at the meetings. I agreed to try and work out a plan to do that and make it feasible to move the organization forward. I asked Rog Woodard, who was then at OSU and working closely with me on the Buffet project, to be the associate director for resources and asked Doug Wolfe, as chair of OSU Statistics, if the department could provide a course relief for Rog and I to take on those jobs. Everyone agreed, and we began to work.

Of all of your activities and accomplishments in statistics education, which one are you most proud of?
I guess that would have to go to building up CAUSE, since that has had the most effect. ■

—To continue reading this interview, visit the *Journal of Statistics Education* website at *https://goo.gl/Mpq9Ca.*

30 Years of Teaching Behind Her, **Roxy Peck** Says There Are No Mistakes

Jill Talley, ASA Public Relations Manager

Roxy Peck is professor emerita of statistics at California Polytechnic State University, where she served as chair of the statistics department for six years and as associate dean of the college of science and mathematics for 13 years. A fellow of the American Statistical Association, she also is an elected member of the International Statistical Institute. She has received numerous awards throughout her career, including the ASA Founders Award and the Lifetime Achievement Award in Statistics from the US Conference on Teaching Statistics. She also has served as past chair of the Joint ASA/NCTM Committee on Curriculum in Probability and Statistics for Grades K–12 and the ASA Section on Statistical Education.

There are no mistakes, only lessons.

That commentary rings true with Roxy Peck, professor emerita of statistics at California Polytechnic State University (Cal Poly), who credits her students with reminding her of the value in trying. "The most important thing I have learned from students is that it is okay to make mistakes, as long as you learn from them."

Wanting to equip students with knowledge is a passion shared by teachers of any discipline. But, Peck, armed with 30 plus years of teaching experience, notes it's when educators change things up that they can change a life. "Experimenting in class and trying different things is not only acceptable, it's how we make improvements and become better teachers. I've found that students respect that if they know you really care and have their best interests at heart."

Even in her childhood, Peck was familiar with change. The daughter of a reporter who advanced up the corporate ladder to bigger newspapers in larger cities, she moved around often, living in the suburbs of Cleveland, Chicago, New York City, and finally Los Angeles, where she attended high school and has lived ever since. The first person in her family to graduate from college, Peck majored in social science. "It was the '60s," she chides, "and everyone I knew was majoring in political science or sociology or psychology. I obviously didn't get very good advice when I was in high school!"

It wasn't until her senior year of college that she was introduced to statistics, and even then only as a requirement for graduation. "I really enjoyed it, and later took a second class that was offered by F.N. David called 'Games, Gods, and Gambling'." David was the chair of the statistics department at the University of California, Riverside, at the time, and Peck credits both the instructor and the course for shaping her career. "That was what made me decide that statistics and probability were really interesting and started me on the path to where I am today."

Two years after graduating, she decided to pursue additional education. Initially thinking she'd earn a second bachelor's degree in statistics, she instead went on to earn a master's degree in mathematics and PhD in applied statistics over the next five years.

Throughout her career, Peck established a nationally recognized presence as a leader in statistics education. Remembering what life was like as a student—the demands, adapting to different teaching styles, and workload—she's been active in initiatives that aim to improve and expand statistics education for both students and teachers.

Along with educators from across the country and officials at the U.S. Census Bureau, she helped launch Statistics in Schools in 2000, a

United States Conference on Teaching Statistics (USCOTS) Lifetime Achievement Award winners (from left): Roxy Peck (2009); Dick Scheaffer (2011); Joan Garfield (2007); and George Cobb (2005)

MORE ONLINE
Read more about the United States Conference on Teaching Statistics (USCOTS) at *www.CAUSEweb.org.*

nationwide program to introduce statistics activities and resources into K–12 classrooms. "If you use artificial and contrived examples, students don't really get the sense that it [statistics] really is useful and used to answer important questions that could impact their lives," she said in an interview last December with the *San Luis Obispo News Times.*

"Statistics is still poorly taught in some places that still focus on the procedural aspect of the subject. But now there are many good textbooks and professors and high-school teachers who provide more of an emphasis on statistical thinking and conceptual understanding, and this is a really good thing." In addition to authoring textbooks on introductory statistics, Peck is a co-editor of *Statistical Case Studies: A Collaboration Between Academe and Industry* and a member of the editorial board for *Statistics: A Guide to the Unknown, 4th Edition.*

Serving as the chief reader for the Advanced Placement (AP) Statistics Exam from 1999–2003, she led efforts to make subject-matter decisions during the exam-construction process and guided hundreds of teachers through the grading procedure. And, when the College Board began redesigning the SAT in 2014—a move critics and even many academic test reviewers argue negatively affected English Language Learners (ELL) and other disadvantaged groups—Peck was outspoken about some of the changes. She noted that specific changes could lead to confusion, as some problems were either not mathematically sound, had incorrect answers, or were unrealistic.

Though college entrance exams have changed formats over the years, higher education institutions continue to place value on them, a tactic in which Peck has seen both pros and cons. "If you had asked me several years ago if colleges would begin to place less weight on standardized test results, I would have said that we would see less emphasis on admissions tests because they didn't always successfully measure the right things and were not always very good predictors of student success in college. But, I think the new revised SAT does a much better job of this, and so maybe it will be more useful in making admissions decisions at competitive institutions."

As time will tell how teaching techniques and exams evolve, so too will it generate a new crop of savvy students and thought-provoking teachers, who—focusing on statistics as a scientific discipline—can continue to expand awareness of the value of statistics education. Peck looks forward to this and believes "perhaps in another 10 years, we won't hear students say statistics was their worst class in college." ■

Martha Aliaga
The Charismatic Teacher

Val Nirala, ASA Publications Coordinator

When asked about Martha Aliaga, the word that comes to mind for most people is "teacher." It seems everyone who knew her has a story to tell illustrating her special charisma and passion for teaching.

Roxy Peck—emerita associate dean of the college of science and mathematics and professor of statistics emerita at California Polytechnic State University, San Luis Obispo—recalls this story:

> "Let Me Tell You About My Daughter" is my favorite Martha classroom demonstration. She would say, "Let me tell you about my daughter," and then she would say she wanted to sew a blouse for her daughter using the fabric pictured on the cover of her book [*Interactive Statistics*]. She would hold up a large piece of that fabric and say she didn't want to buy a lot of it before she was sure her daughter would like it, and she wondered how much she should buy as a sample to show her daughter. She would hold up a tiny swatch that clearly wasn't enough to capture the pattern, and everyone would say, "No, no that isn't enough." Then she would hold up a slightly bigger piece—still not enough. And another—still not big enough. But then she would hold up a piece that was about 5 inches by 5 inches, and every one would say, "Yes, that's enough."
>
> Students got the idea of a sample being representative of a larger piece. But then (and this is what I think is the brilliant part of the lesson, because it addresses a common student misconception), she would say, "Well, I only need 1 yard of fabric for the blouse, but I think I may also want to make some curtains for my daughter's room out of the same fabric. To do that, I will need 10 yards of the fabric, so if I am going to show my daughter a sample, I had better get a sample piece that is 10 times as big."
>
> Students clearly saw this wasn't necessary and would often argue with her, saying she didn't need a bigger piece of fabric for her sample. She was then able to explain that the size of a sample needed to get a good sense of a population doesn't really depend on the size of the population, if the sample is well chosen.
>
> That was typical of the way she challenged students to think about statistical concepts—by relating them to everyday things they could relate to.

Already a longtime member of the ASA, Aliaga joined the staff in August of 2003 after a distinguished career at the University of Michigan. While at Michigan, she won the First Prize in Statistics for Innovative Programs Using Technology and two awards for excellence in teaching. She also coauthored *Interactive Statistics* and was elected an ASA Fellow.

Aliaga's tenure at the ASA brought about the ASA's Educational Ambassadorship Program, which Aliaga and the Committee on International Relations in Statistics launched in 2005. Within the program, an ambassador attends continuing education courses during the Joint Statistical Meetings and then returns to his or her country to teach the new subject matter. This way of passing statistics education forward has allowed statisticians to reach students in every corner of the world.

Aliaga also believed in starting statistics education early, and was a tireless advocate for K–12 curriculum in statistics. Now under the direction of the ASA/NCTM Joint Committee on Curriculum in Statistics and Probability, she created the Meeting Within a Meeting Statistics Workshop for K–12

MORE ONLINE
Read more about Aliaga at *http://magazine.amstat.org.*

In Their Own Words

Martha Aliaga and Rebecca Nichols in Slovenia, 2010

Knowing Martha Aliaga meant having stories to tell. Here, colleagues relay experiences with her that continue to make them smile.

Rebecca Nichols, ASA Director of Education

I was particularly excited to go with her [Aliaga] to the International Conference on Teaching Statistics in Slovenia in 2010, which was my first international conference. We met at Reagan National Airport and were all set to board our flight when something happened with the plane and they had to cancel the flight. They scrambled and got us on another flight to Amsterdam, leaving instead out of Dulles, that would get us there in time to catch our connection to Slovenia. It was going to be tight, so we jumped in a taxi and headed for Dulles.

We didn't have any bags to check, but had to wait in a huge line to get our new boarding passes. It was looking like we just weren't going to make our flight and would then miss our international connection when Martha chanted, "I'm from Argentina!"

She proceeded to work her magic as only Martha could by cutting in front of the huge line without making people mad, showing her special United card, and kindly working it out with the agent so we could quickly get our tickets and barely make our flight.

She had to do something similar for the other legs of the trip, because part of her ticket was mistakenly cancelled when they changed our tickets. She managed to get us where we needed to be. We made it to Slovenia just fine, and she did a great presentation, as always.

Rick Peterson, ASA Professional Development and Chapters and Sections Manager

We had launched the Census at School website and Martha and Rebecca [Nichols] planned a series of Saturday workshops for high-school teachers in the Washington, DC, area at the ASA office. These workshops were to introduce the teachers to Census at School, give advice on how to collect data, and provide exercises the teachers could use in their own classrooms.

It was Friday afternoon before the first workshop and I could hear Martha and Rebecca in the office next door going over logistics. I looked up from my monitor and saw Martha and Rebecca in my doorway looking, for lack of a better word, sheepish.

My name is Rick, but when Martha said my name in her Argentinian accent, it always sounded like Rēk. So, Martha said, "Rēk, Rebecca and I have a favor to ask you." I already knew what the question was, and I knew I would capitulate because it was Martha after all, so I replied, "Martha, what time would you like me to be here tomorrow morning?"

math and science teachers and STEW, a peer-reviewed repository of lesson plans. She also introduced Census at School in the United States and created the K–12 statistics education webinar program. All these initiatives deliver training to K–12 teachers or provide resources for their success.

Jerry Moreno, assistant professor emeritus of statistics at John Carroll University, says, "Behind her incredibly warm smile, was a mind continuously thinking of new ways to help students and teachers learn statistics. I recall when she was formulating STEW that I had some reservations about it. But she would listen and then reframe the project. Her insights far exceeded mine, as STEW has become a useful resource of lesson plans in statistics for teachers."

Aliaga was also a strong supporter of women and minorities and served as president of the Caucus for Women in Statistics in 2002. Additionally, she participated as the only instructor for a National Science Foundation program for middle-school minority girls in Ann Arbor, Michigan, and was invited to give workshops in many countries.

Current ASA Director of Education Rebecca Nichols says, "I always loved going to statistics education conferences with Martha because she seemed to know everyone and it was like she was introducing me to her family. Martha was a master teacher who could explain complex ideas with simple, clever, and often witty examples. She loved teaching, loved students, and loved people."

Rick Peterson, ASA professional development and chapters and sections manager, says, "Working with Martha was probably the fondest time of my professional career. Her drive and passion for statistics education was infectious. I remember the Meeting Within a Meeting and Census at School programs when they were just preliminary ideas Martha had. But once she decided these were programs we were going to implement, there was no stopping her."

Aliaga passed away in October of 2011; however, the programs she imagined continue. STEW was integrated into *Statistics Teacher,* an online journal for statistics educators published by the ASA/NCTM Joint Committee on Curriculum in Statistics and Probability (see *www.statisticsteacher.org*). Meeting Within a Meeting was held for the 11th time and the 12th Educational Ambassador made it to JSM in Baltimore, Maryland, this year. And last but not least, U.S. Census at School just released a random sampler that generates samples from the entire messy US database for teachers who wish to provide their students with messy data to clean and investigate. All these programs and more can be found on the ASA's website at *www.amstat.org/asa/education/K-12-Educators.aspx.* ■

Nick Horton

An advocate for modernizing the undergraduate statistics curriculum

Jill Talley, ASA Public Relations Manager

Nick Horton is a professor of statistics at Amherst College. He is the recipient of numerous awards, among them the Robert V. Hogg Award for Excellence in Teaching Introductory Statistics, William D. Warde Statistics Education Award, Waller Award for excellence and innovation in the instruction of elementary statistics at the undergraduate level, the ASA Founders Award, the Kathleen Compton Sherrerd and John J. F. Sherrerd Prize for distinguished teaching, and the *Journal of Statistics Education* award for best paper. A fellow of the ASA, he served as chair of the Committee of Presidents of Statistical Societies (COPSS) and has more than 150 publishing credits. He earned his AB from Harvard College in 1987 and ScD from the Harvard School of Public Health in 1999.

If there were a poster child showcasing the diversity in statistical applications, it would be Nick Horton, professor of statistics at Amherst College. From computer science to communication to biostatistics to education, Horton pulls from a number of buckets as he teaches students to "think with data" from the beginning.

Horton's beginning was in Albany, New York, where he served as editor of his high-school newspaper. His interest in statistics blossomed during college as he majored in what seemed like an unrelated subject—psychology—and completed a number of computer science courses. "Tukey-inspired exploratory data analysis (EDA) was in the air, and I was hooked," he remembers. Interestingly, his thesis involved the collection of pre- and post-data for first-year students completing a quantitative skills requirement.

Following college, Horton struggled in the job market, just as many undergrads across the country are doing today. "I was blissfully under-employed for seven years, working as a computer facilities manager in Portland, Oregon."

While those computer science courses came in handy, Horton eventually pursued a graduate degree in biostatistics and focused on analyzing data from substance abuse and psychiatric epidemiology studies. So meaningful was that primary research area, he suspects his career would have moved in the direction of public health if he was not involved in teaching statistics.

Horton—an advocate for modernizing the undergraduate statistics curriculum—served on a working group responsible for creating the Statistical Commons Website, a repository for sharing course materials such as lecture slides, exams, and data sets. He played a major role in updating the ASA's *Guidelines for Undergraduate Programs in Statistical Science* in 2014, even co-authoring a guest editorial about undergraduate statistics curriculum in *The American Statistician* (volume 69, issue 4). In that, he challenged the statistical community to find ways to "ensure students have flexible problem-solving skills so they can tackle future problems using data with techniques and technology."

Beyond the college campus, Horton's passion to teach statistics encompasses high-school students in both introductory and AP Statistics programs. His motivation helped lead to the formation of the ASA's public education campaign, *This* Is Statistics, which shares educational and career resources in statistics with high-school and undergraduate students, teachers, school administrators, and parents.

From left: Julia and Nick Horton, Katherine Monti, and Janet Buckingham take time for a picture at the Fellows reception during the 2012 Joint Statistical Meetings in San Diego.

As chair of the Committee of Presidents of Statistical Societies, Nick Horton addresses the committee during the 2016 Joint Statistical Meetings in Chicago.

Nick Horton, representative from the Council of Chapters (2012–2014), with Bonnie LaFleur, representative from the Council of Chapters (2011–2013), during the JSM 2012 ASA Board meeting

Former student Mariel Finucane, who was reluctant to enroll in a statistics class, credits Horton with showing her the positive that can come from the messiness of data and estimation. "In my junior year, I ran out of math classes to take, and although I considered myself a devout purist, I was left no better option than to enroll in his class. It turns out that I was in for a wonderful surprise. It was thanks to Nick that the light went on: Numbers hide within them fascinating information about health, politics, and science."

Conveying that excitement and generating a spark in students is no easy task, but Horton believes the power lies in a different teaching technique. "All too often, statistics has been taught as a cookbook with rote memorization of recipes. Best practices for teaching statistics now encourage us to teach 'cooking skills' as a creative and principled way to make sense of data."

Today, it's not only his students who are learning. Horton appreciates the work of his longtime mentor, George Cobb, even now. "I continue to learn so much from him about how to be a better teacher, researcher, adviser, and person. He has a quote that is a favorite of mine: 'Changing curriculum, like moving a graveyard, depends on local conditions.' " ■

Teaching Statistical Literacy to Non-STEM Majors: Challenges *and* Opportunities

Michelle Everson, The Ohio State University, and
Ellen Gundlach, Purdue University

Michelle Everson is a professor and program specialist of statistics at The Ohio State University and former editor of the *Journal of Statistics Education*. Since earning her PhD in 2002, she has been teaching introductory and intermediate statistics courses. She is particularly interested in distance education and ways to actively engage students in online learning environments.

Ellen Gundlach has been teaching and coordinating several introductory-level courses since 2002. She co-authored a probability book with Mark Daniel Ward and has also won several teaching awards. She is an associate editor of the *Journal of Statistics Education*.

We teach statistical literacy to non-STEM majors in public midwestern universities using large-lecture traditional, fully online, and flipped teaching methods. Between 500 and 1,100 students enroll in our courses each semester, and we both not only teach sections of these courses, but we also serve as the course coordinators (with valuable assistance from many talented graduate teaching assistants (GTAs) who lead recitation sessions and sometimes serve as lecturers).

Our students are more likely to be consumers of statistical information than producers of statistics. As such, we want them to be able to develop the necessary skills to reason carefully through statistical information to better understand important issues in society today, such as whether to vaccinate their children, whether the American Community Survey is a good use of our tax dollars, how Big Data is something to be both excited and cautious about, how to interpret medical test results, and whether to panic when a local news station suggests there may be a cancer cluster in the community.

GAISE Guidelines

The 2005 *Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report* and the recently revised *GAISE College Report* have had a profound effect on our thoughts about how to best structure and teach our statistical literacy courses. The *GAISE College Report* recommends teachers of first courses in statistics (1) teach statistical thinking; (2) focus on conceptual understanding; (3) integrate real data with a context and purpose; (4) foster active learning; (5) use technology to explore concepts and analyze data; and (6) use assessments to improve and evaluate student learning.

Given that our courses are designed to help students become critical and thoughtful consumers of statistical information, there is a strong emphasis in our classrooms on learning the language of statistics and understanding the big ideas.

TECHNOLOGY—often in the form of applets and statistical software such as JMP—is used to illustrate different ideas and concepts (such as distributions of sample statistics or correlation), to graph data, and to perform calculations. Whenever possible, we attempt to use real data that has been gathered from our students or that comes from published research. We use this data to better illustrate the investigative nature of statistics. We want our students to know that data, if gathered under the right conditions, can help us answer important questions. We also want our students to appreciate the need to ask critical questions when they are trying to make sense of data.

To determine if students are meeting the learning objectives in our courses, we use a variety of formative and summative assessments, including clicker questions, weekly homework assignments and lab activities, projects, and exams.

What to Teach

Topics That Work

Our students appreciate daily connections to current events so they can see immediate relevance of statistical literacy to their daily

We make it clear how statistics and math are different, and we attempt to emphasize that we use math as one of our tools to understand what is happening in the world.

lives. This can be accomplished through a "statistics in the news" segment incorporated into each lecture or with whole lectures written to explain a particular hot topic.

For example, during election season, understanding how pre-election polls could vary from each other and the final election outcome allowed us to discuss sampling variability, sample size, margin of error, sampling design, response bias, undercoverage, and nonresponse. When the Affordable Care Act was being debated by Congress, we talked about how the Law of Large Numbers is important to the business plans of insurance companies. A few years ago, Facebook announced results from an experiment it performed on hundreds of thousands of users without explicit permission, and this led to discussions about exactly what informed consent means and whether Facebook is considered a "public space" that would allow some exemptions from usual informed consent rules.

We've enjoyed sharing and discussing news articles about topics we think our students will relate to and find interesting. For example, we've talked about whether Facebook use has a negative effect on GPA, whether dogs like to be hugged, if college students will literally "text through anything," if using electronic devices during class affects learning, the typical cost of a wedding, the best day of the week to weigh yourself, the best excuse to give if you ever need to call in sick to work, whether the outcome of a coin toss can predict the winner of a football game, and the calorie content of Chipotle burritos.

We also frequent YouTube and share many video clips in our classrooms. Videos from the "Colbert Report," "Saturday Night Live," "Bill Nye the Science Guy," Neil deGrasse Tyson's "Cosmos," TED talks, and, of course, Hans Rosling's "The Joy of Stats" all enliven explanations and discussions while showing the wide-ranging relevance of statistics.

Topics That Don't Work

Many of our students have math anxiety, or at least a strong dislike for anything math-related, so we carefully plan our courses to build confidence and show students many examples with step-by-step guidance and ample opportunities to practice alone and in groups. We make it clear how statistics and math are different, and we attempt to emphasize that we use math as one of our tools to understand what is happening in the world. About one-third of our topics are taught primarily with words instead of numbers. Proofs are not as important for students as understanding what the results of their data explorations mean and how to communicate these results to others.

How to Teach

Active Learning

We attempt to incorporate many opportunities into our courses for students to play an active role in the learning process. Although we both teach in large lecture halls, we use clickers to engage our audience and give as many students as possible the opportunity to be part of class discussion. This has allowed us to sometimes gather data from our students that we can incorporate into future class discussions to illustrate particular ideas or concepts. Clickers also allow us to gauge whether our students have read assigned course readings or whether they have misconceptions or misunderstandings. At The Ohio State University, students have free access to a system called Top Hat that allows them to use their cell phones as clickers, therefore turning a device that sometimes distracts students into a valuable educational tool.

Whenever possible, we try to bring as much activity and discussion as we can into the lecture hall. One favorite activity involves trying to conduct a horrible experiment with students by simply dividing the lecture hall in half and asking each half of the room to try to remember a different list of words read aloud by the instructor. Many lurking variables are built into the experiment, and, because students are active participants in the experiment, they often have much to say about the shortcomings of the experiment and how a better experiment could be designed to assess memory for words. Our hope is that this exercise will

be more powerful than simply describing what an experiment is and telling students about the terms and ideas related to experimental design.

When students are not in our lecture halls, they are in smaller recitation sections in which they work through lab activities with their peers under the guidance of our GTAs. Many of these activities involve wrestling with problems in which students need to apply what they have learned through lecture and course readings. Students are encouraged to work through these problems with peers and use technology to arrive at solutions. We attempt to structure each lab activity around a question that students need to answer, often with real data.

As an example, in our first recitation activity (inspired by a webinar from the Consortium for the Advancement of Undergraduate Statistics Education [CAUSE], *www.causeweb.org/cause/webinar/activity/2010-11*), we break students into groups of three and give each group two small rubber pigs from the game Pass the Pigs. We tell students to imagine they are trying to gather information to be used to design a game that will incorporate the pigs. We also tell students that each pig can land in one of six possible ways, and we ask each group to come up with and execute a plan to gather enough data to determine how often a pig would be expected to land in each of the six positions. Each group is then asked to summarize their data and share it with their peers.

We start our semester with this activity because we've found it to be a good way to introduce the idea of statistics as an investigative problem-solving process, and we also find that we can use it to illustrate and foreshadow many of the topics that will be covered in the course.

For instance, students have to think carefully about what it means to "summarize" a data set, and it's always interesting for us to see what kinds of summaries they choose to share. We can question students about the sample size they choose and what they think might happen if they were to increase the sample size. We can ask them if they would feel comfortable generalizing their results to a larger population, and we can ask them if they think factors such as how they tossed the pigs and the surfaces they tossed the pigs onto might have had an effect on their results. We can even present a claim to them about how the pigs should land, and we can ask them if they think they have found evidence in support of or against this claim.

For all these reasons, we find this to be a rich activity to which we can refer many times to better help students see the connections among different topics in the course. It also tends to be a fun way to start a new semester and break the ice with our students.

Other recitation activities have involved exploring data on movies to determine if a movie's budget affects the revenue it generates, using Zener cards to determine if students have ESP (to illustrate important ideas of hypothesis testing), playing games (such as those developed by Shonda Kuiper at *http://web.grinnell.edu/individuals/kuipers/stat2labs/Labs.html*) to better understand the principles of experimental design, and examining the distributions of colors in M&M candies to illustrate the idea of the sampling distribution.

We have also tried to use different projects in our course. One group project (inspired by work presented at the Electronic

Conference on Teaching Statistics (eCOTS, *www.causeweb.org/ecots/ecots12/breakouts/2* and *www.causeweb.org/ecots/ecots14/36*) involved finding an advertisement that uses data to make a claim about a product and then doing research to determine if that claim is credible. Another project involved asking students to keep track of data from their daily lives (e.g., number of steps taken per day, minutes spent texting per day, calories consumed per day, etc.) for several days and then use technology to explore the data. Yet another project involved asking students to keep a journal of news reports they were seeing that involved statistics in some way (e.g., poll results, graphical displays of data, descriptions of research studies, etc.).

Big Data is a hot topic in the news, and while our students might not have the skills and technology to analyze Big Data, they are contributing to Big Data with daily activities online, so another project asks them to keep a 24-hour data diary in which they record everything they do within a 24-hour period where data could be collected

Helpful Resources for Planning Courses

While some of our best ideas come from talking to colleagues or paying attention to what is in the news, here are some other resources we have found especially helpful:

Consortium for the Advancement of Undergraduate Statistics Education (CAUSE), *www.causeweb.org*

This site has been compiled by statistics educators for more than a decade, beginning with a National Science Foundation grant. We especially like the webinars (Teaching & Learning, Activities, and *Journal of Statistics Education* author talks), but there are labs, projects, jokes, songs, data, lesson plans, quotes, and many other resources.

United States Conference on Teaching Statistics (USCOTS) and Electronic Conference on Teaching Statistics (eCOTS), *www.causeweb.org/cause/events*

These conferences (in person for USCOTS, online for eCOTS) are wonderful ways to connect with the statistics education community. Having conversations over meals at USCOTS is ideal, but even looking through the resources posted on the CAUSE website once the conferences have ended can be inspiring. Many big changes in the statistics education field such as teaching hypothesis testing through simulation were born and nurtured at these conferences.

Journal of Statistics Education (JSE), ww2.amstat.org/publications/jse

This free online journal contains excellent scholarly articles about research in statistics education, interesting data sets with suggestions for how they can be used in the classroom, interviews with leaders in the field, and summaries of interesting articles in other journals that could be relevant to teaching statistics.

Multimedia Educational Resource for Learning and Online Teaching (MERLOT), *www.merlot.org/merlot/Statistics.htm*

This is a collection of online resources such as applets and modules that can be used as part of lab activities, lecture demonstrations, or at-home practice for students.

Science Daily*, *www.sciencedaily.com

We both signed up for the daily email newsletter, which updates us on many new scientific articles published in a wide variety of fields. Almost every day, we can find a good experiment or observational study to bring to our students from this newsletter.

Assessment Resource Tools for Improving Statistical Thinking (ARTIST), *https://apps3.cehd.umn.edu/artist/index.html*

This is a collection of assessment resources for first courses in statistics. Over the years, we've used many of the assessment items from this site and been inspired to create course projects based on sample projects included here.

from them, investigate two privacy policies, write a "Big Data privacy bill of rights," and share an exciting use of Big Data in a field that interests them.

One other favorite project we have used is an online discussion and investigation into the research on one of a student's own good or bad habits. This gives our students the chance to talk with each other about a topic of personal interest to them, and students seem to enjoy the chance to get to know each other and critique research that has immediate implications for how they behave each day. Details about several of these projects were shared through a CAUSE webinar at *www.causeweb.org/cause/webinar/teaching/2015-03*.

Finding Ways to 'Hook' Students During the First Lecture

First impressions are important, and we constantly strive to put our best foot forward on Day 1 of every new semester. We know our students are often not happy to be taking a statistics course, and we sometimes question if they see the relevance of it. We want our students to walk away from our courses with a new appreciation for the fact that data are all around them all the time and there are many decisions they will make in their lives that will require a careful and mindful synthesis of statistical information. We want to provide students with the tools to critically evaluate the statistical information we know they will be bombarded with on a regular basis outside our classrooms. We also want them to appreciate the active nature of our courses.

A typical first day might involve asking students to meet and greet some of their peers.

Students are given a few minutes to meet as many of their classmates as they can and gather information from each classmate. This activity, and the information gathered, can then be used to illustrate several of the new terms students will read about in the first two chapters of their textbook. We've found the activity works even in large lectures halls.

We also like to spend the first day sharing several snippets from the news. For instance, we will compile several recent stories that include the results of a study or survey aimed at answering a particular research question. We'll share the research questions with students and ask them to tell us what they think the answers are. We will then tell students what the news stories actually claim the answers to be. Many of these stories are ones we'll come back to at different times during the semester to introduce different concepts, and some of the stories have flaws we will eventually critique as a class. Our hope is that sharing these stories right away will better illustrate the relevance of the course content and the usefulness of the content in navigating daily life.

We also try, as much as possible, to not spend a great deal of time talking about the syllabus on Day 1; instead, we might have a syllabus quiz or a syllabus scavenger hunt activity for students to work on outside of class.

Learn About Student Interests and Incorporate Them into Their Work

It's critical, particularly because we teach large courses, for us to get to know our students and learn about their backgrounds, interests, and concerns. Students from many departments take our courses, and this makes for a great deal of diversity in our classrooms. We might have students who are brand new to college or students who have put off our courses until the end of college and are just about to graduate.

The majority of our students are taking our course because they must to fulfill a general education requirement, and this is not necessarily a course they would have chosen on their own. Some students might have negative attitudes or misconceptions about the course content. As soon as we can, we attempt to gather information from our students to help ease their concerns and find out more about what they are passionate about.

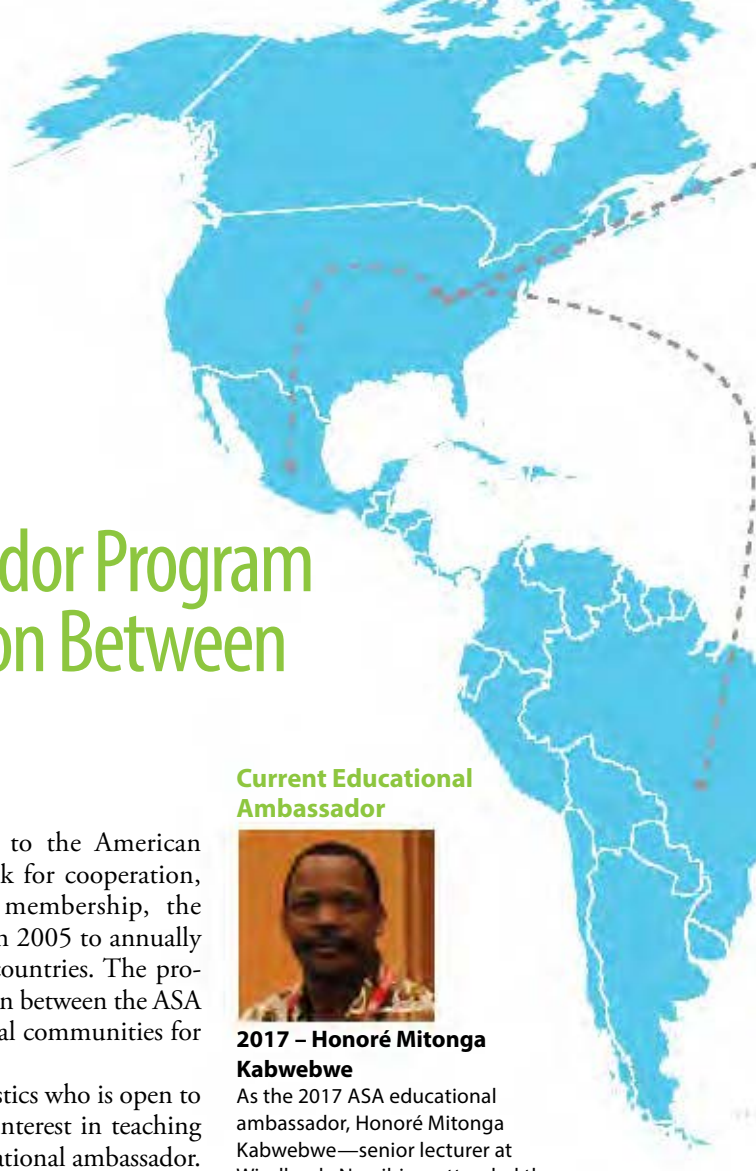
During our first lectures, we often accomplish this by handing out index cards and asking the students to write down answers to questions about themselves. We then collect the cards and spend time reading through and responding to them. We might notice, for example, several students from similar majors, or several students who enjoy athletics or are involved in athletic programs on campus, and this might give us ideas for examples we can share during future class discussions. We can also reassure the students who have anxiety about math that this is a course designed for people exactly like them, and we are happy to help them along the way.

Traditional, Online, Flipped Delivery Formats

We both teach our courses in multiple formats, and this gives our students more opportunities to choose a format they think will work best for them or fit best into their schedule. In addition to teaching in a traditional, face-to-face setting, we also teach sections almost completely online (with the exception of exams that students must take in proctored settings). At Purdue, there is also a flipped section that presents the lectures online but has the students meet weekly to solve problems or do hands-on activities to reinforce the material. We have found the attitudes, learning, and performance of students in all three types of section to be fairly similar, but the students appreciate having an opportunity to choose.

What We Want

We both enjoy the challenge of explaining the importance of statistics to an audience that might not have an appreciation for this discipline before taking our class. We want to send our students into the world as informed citizens who are curious and willing to challenge speakers, reporters, politicians, medical care providers, advertisers, and others about where their data and conclusions come from. We are not trying to create cynics, but we do want to empower our students to ask questions and think critically, rather than simply accept what they are hearing and reading at face value. We want our students to appreciate logic and good investigative procedures. We want them to understand the quality of their sources of information, and we want them to appreciate how much information the right graph can convey, what sampling variability is, and how a properly selected sample can represent a much larger population. We know our students will leave our classrooms and be expected to make sense of a world filled with data, and, most of all, we want to make sure they have the tools to get them started on their journeys. ■



Educational Ambassador Program Advances Collaboration Between ASA and World

Geert Molenberghs

The ASA's Educational Ambassador Program was founded by the late Martha Aliaga, former ASA director of education. Aliaga was passionate about statistical education and international outreach.

To welcome new international members to the American Statistical Association, to create a network for cooperation, and to serve the non-US-based ASA membership, the Educational Ambassador Program was launched in 2005 to annually recruit an educational ambassador from foreign countries. The program was developed to advance lasting collaboration between the ASA and other international statistical societies and local communities for permanent exchanges of knowledge.

Someone holding a PhD in statistics or biostatistics who is open to studying a new area of research and who has an interest in teaching this new area of research is qualified to be an educational ambassador.

Every year, the Committee on International Relations in Statistics selects the country that will host the educational ambassador and typically identifies a liaison for that country. The ASA then launches a call for nominations and applications via *Amstat News* and other channels.

When possible, a local liaison supports the identification process of valuable candidates. Such a liaison is, for example, a prestigious statistician native to the country who works in the United States or someone who knows the country well.

Once the deadline for applications has passed, the Committee on International Relations in Statistics selects an educational ambassador.

Educational ambassadors are subsidized to attend the Joint Statistical Meetings. At JSM, the chosen educational ambassador will attend several continuing education (CE) courses in an emerging area of research and of importance to their country and broader region. The ambassador also receives ASA full membership for one year. The educational ambassador will then return to his or her home country and—within the next year—teach classes, give workshops at conferences, and undertake other dissemination activities based on the knowledge and skills acquired at JSM.

The educational ambassador reports back to the Committee on International Relations in Statistics about his or her experiences.

The majority of educational ambassadors go far beyond the minimal requirements. For example, some have started teaching classes in topics studied at JSM not just once, but as part of a regular master curriculum. As such, they disseminate the knowledge for years on end.

Current Educational Ambassador

2017 – Honoré Mitonga Kabwebwe

As the 2017 ASA educational ambassador, Honoré Mitonga Kabwebwe—senior lecturer at Windhoek, Namibia—attended the Joint Statistical Meetings in Baltimore, Maryland, and completed continuing education courses.

Past Educational Ambassadors

2016 – Adedayo Adepoju, Nigeria

As the 2016 ASA educational ambassador, Adedayo Adepoju—senior lecturer and former acting head at the department of statistics, University of Ibadan, Nigeria—attended the Joint Statistical Meetings in Chicago, Illinois, and completed courses on Bayesian methods, bootstrap and permutation methods, and ordinal categorical responses.

2015 – Mohammad Shafiqur Rahman, Bangladesh

As the 2015 ASA educational ambassador, Mohammad Shafiqur Rahman—associate professor of applied statistics at the University of Dhaka—attended the Joint Statistical Meetings in Seattle, Washington, to participate in continuing education courses.

2014 – Juan Carlos Salazar Uribe, Colombia

As the 2014 ASA educational ambassador, Juan Carlos Salazar Uribe of the Universidad Nacional de Colombia attended the Joint Statistical Meetings in Boston, Massachusetts, to participate in continuing education courses. He was particularly interested in a course on applied longitudinal analysis.

2012–2013 – Keamogetse Setlhare, Botswana

The 2012 educational ambassador was Keamogetse Setlhare from the University of Botswana Department of Statistics in Gaborone. She attended the 2012 Joint Statistical Meetings in San Diego, California, and the 2013 Joint Statistical Meetings in Montréal, Québec, Canada. Setlhare took courses in Bayesian methods and computation, simulation and sampling of data, and analysis of univariate and multivariate extremes, as well as several computer technology workshops.

2010–2011 – Eiliana Montero Costa Rica

In 2010, the educational ambassador was Eiliana Montero of the University of Costa Rica. In 2011, Eiliana presented "A First-Time Course in Modern Causal Inference at the University of Costa Rica" during the JSM contributed session From Courses to Majors, sponsored by the Section on Statistical Education.

2009 – Tatevik Zorhrabyan and Alexan Simonyan, Armenia

There were two educational ambassadors in 2009: Tatevik Zorhrabyan and Alexan Simonyan, from Armenia. Both took several CE courses and plan to teach what they learned in Armenia. They also created the Armenia Statistical Association.

2008 – Idir Ouassou, Morocco

The 2008 educational ambassador was Idir Ouassou from Marrakech, Morocco. He teaches at the Universit Cadi Ayyad Ecole Nationale des Sciences. During JSM 2008, in Denver, Colorado, he attended the course Generalized Linear Mixed Models: Theory and Applications and the computer technology workshops An Introduction to Stat Studio for SAS/STAT Users, Introduction to Bayesian Analysis Using SAS Software, Nonparametric Regression Modeling in SAS Software, and Structural Analysis of Time Series Using the SAS/ETS UCM Procedure.

2007 – Loan Le, Vietnam

The 2007 educational ambassador was Loan Le, from Ho Chi Minh City. She is the vice director of the government statistics office and chose to attend three classes during JSM 2007 in Salt Lake City, Utah: Latent Class Analysis of Survey Error, Modeling and Data Analysis for Complex Surveys, and Categorical Data Analysis.

2006 – Eshetu Wencheko, Ethiopia

The 2006 educational ambassador was Eshetu Wencheko, from Ethiopia. Wencheko, president of Alpha University College in Addis Ababa, took two classes during JSM 2006 in Seattle, Washington: Generalized Linear Mixed Models and Generalized Linear and Latent Mixed Models. He then taught a class in generalized linear mixed models to 14 graduate statistics students in Ethiopia.

2005 – Diana Kelmansky, Argentina

The first educational ambassador was selected in 2005 from Argentina. Diana Kelmansky teaches at the University of Buenos Aires. She selected the continuing education course Analysis of Gene Expression Data, presented by Terrence Speed and colleagues at JSM 2005 in Minneapolis, Minnesota. The title of her invited presentation in 2006 was "Building Statistical Capacity in Developing Countries." Kelmansky presented her class at the University of Buenos Aires and repeated the class in Ecuador and Spain. She also co-taught the class with Speed in Mexico. After that experience, she wrote the class notes in Spanish and was invited to make presentations at three conferences in Argentina and one in Chile. ■

As Seen Through the Eyes of ASA's K–12 Statistical Ambassador:

The State of K–12 STATISTICS EDUCATION

Christine Franklin,
ASA K–12 Statistical
Ambassador

I am thrilled for this opportunity to briefly share news about my role as the ASA K–12 Statistical Ambassador. As I write this article, I am traveling to 'down under' to spend a week in Canberra, Australia, and attend the Australian Association of Math Teachers (AAMT) conference.

AAMT is the Australian equivalent to the USA National Council for Teachers of Mathematics (NCTM). I am representing the ASA, presenting a keynote address and two breakout sessions, and sharing with our Aussie colleagues the statistical resources and support structures the ASA nurtures and makes available for school-level teachers. Not only am I looking forward to sharing efforts from the United States, I am excited to learn from the research and pedagogical efforts of our Aussie statistics educators.

In today's data-driven society, there is a pressing need for all citizens to become statistical thinkers. The ASA leadership believes this must begin in the early school years, not just for those students who take one introductory college course. It is essential that statistics education is recognized as central to ensuring all graduating high-school students are "college and career ready."

Even with national efforts in the past 50+ years to integrate statistical standards at the K–12 level, students are not receiving the recommended experiences with data analysis and statistical reasoning. One contributing factor is a lack of confidence among school-level teachers to deliver the recommended national statistics standards. Although

most teacher preparation programs recognize the importance of including statistics in their curriculum, math teacher educators are also struggling with their lack of a statistical background.

The K–12 Statistical Ambassador position was created in 2016 in response to the increasing demand placed on school-level teachers to teach statistics. More often than not, these teachers have little or no training in statistical content. There is also concern that there are few good, peer-reviewed statistical resources. The ASA leadership thought these needs were so critical that the board approved this position to provide leadership and continuity in the creation and presentation of professional development materials for teacher educators and teachers. This ambassador would also present at national conferences, conduct workshops, collaborate with ASA chapters to enhance their education initiatives, and provide outreach to the STEM education community.

I was honored when the ASA leadership came to me and asked if I would accept this position. After 36 years as a faculty person in higher education—as much as I have loved teaching and writing as a statistics educator—I thought it was time to begin a new journey to support K–12 education. This position is what I dreamed of doing—to totally focus my efforts at the school level.

It has been almost a year since I began serving in this position and what an exciting, busy year it has been. Here is a summary of leadership roles for the K–12 ambassador:

- Liaison with the Joint ASA/NCTM Committee on Curriculum in Probability and Statistics for Grades K–12
- Serve as managing editor for the new, open resource, peer-reviewed online journal *Statistics Teacher*
- Assist with developing a textbook in statistics for teacher educators, supported by the ASA/NCTM Joint Committee
- Advise the writing team for a statistical modeling book, supported by the ASA/NCTM Joint Committee
- Write about the NCTM High School Task Force, charged with revisiting high-school math and statistics standards
- Facilitate review teams for policy documents of other STEM organizations
- Serve as member of the Career and AP SAT High School Committee
- Assist the ASA education staff with planning and presenting webinars
- Assist with facilitating a collaboration between the Joint ASA-NCTM Joint Committee and New Zealand Statistical Association Education committee

Following is a summary of conferences, workshops, and meetings at which I presented and provided professional development during my first year:

- Eight conferences through July 2017—These conferences include other STEM and complementary areas such as National Science Teacher Conference, National School Counselor Conference, and Association of Mathematics Teacher Educators (AMTE). The ASA has collaborated with AMTE to support teacher educators in statistics.
- Four regional workshops through July 2017—These workshops include a workshop for two-year college faculty teaching statistics, Meeting Within a Meeting for school-level teachers held for two days at the Joint Statistical Meetings, an AMTE regional workshop for teacher educators held in Lansing, Michigan, and a workshop for a Mongolian delegation of university faculty and government officials held at the University of Alabama.
- Ten local and state school visits to present to high-school students the importance of statistics both for career and post-secondary education.

The upcoming months promise to bring continued opportunities for the ambassador position to promote statistics at the school level. Following are a few projects and conferences:

- Co-chairing (with Anna Bargagliotti) the writing team for updating the *Pre-K–12 GAISE Framework*
- Representing the ASA with three presentations at the New Zealand Math Teacher conference in October
- Presenting at the AMATYC conference for two-year colleges

The support the ASA is giving to the K–12 Statistical Ambassador is being recognized both nationally and internationally by organizations that affect school-level education, leading to invitations for the ambassador to present about the ASA's school-level efforts. By creating this position, the ASA Board has sent the message that supporting statistics and our teachers at the school level is a top priority and mission of the organization. I am so appreciative of the ASA's support of K–12 and the confidence in me to serve as the K–12 Statistical Ambassador. ■

Christine Franklin is the ASA's first K–12 Statistical Ambassador. She is the lead author of the *GAISE* pre-K–12 and *SET* reports, a Fulbright Scholar, an ASA Founder, and a former AP Statistics chief reader. To read more about Franklin and the K–12 Ambassador role, visit *http://magazine.amstat.org/blog/2016/04/01/k12ambassador16.*

Updated Guidelines for Statistics Education: The **GAISE 2016 College Report**

Megan Mocko, University of Florida, and Michelle Everson, The Ohio State University

In July 2016, the revised *Guidelines for Assessment and Instruction in Statistics Education (GAISE) 2016 College Report* was endorsed by the ASA Board. The *GAISE* revision committee consisted of 11 members, and these individuals surveyed the larger statistics education community, led panel discussions at the United States Conference on Teaching Statistics (USCOTS) and JSM, and delivered various webinars to gather information to inform the writing of *GAISE*.

The updated report includes the same six recommendations for teaching introductory statistics at the college level as can be found in the original 2005 *GAISE College Report* with two emphases added to the first recommendation.

- Teach statistical thinking.
- Teach statistics as an investigative process of problem solving and decision making.
- Give students experience with multivariable thinking.
- Focus on conceptual understanding.
- Integrate real data with a context and purpose.
- Foster active learning.
- Use technology to explore concepts and analyze data.
- Use assessments to improve and evaluate student learning.

Important changes in wording also were made across these recommendations:

In addition to the inclusion of these new emphases, the original goals for students in introductory statistics courses were re-written in the form of learning objectives and two goals were added. The nine goals in the revised report are as follows:

1. Students should become *critical consumers* of statistically based results reported in popular media, recognizing whether reported results reasonably follow from the study and analysis conducted.
2. Students should be able to recognize questions for which the *investigative process* in statistics would be useful and answer questions using the investigative process.
3. Students should be able to produce *graphical displays and numerical summaries* and interpret what graphs do and do not reveal.
4. Students should recognize and be able to explain the central role of *variability* in the field of statistics.
5. Students should recognize and be able to explain the central role of *randomness* in designing studies and drawing conclusions.

6. Students should gain experience with how *statistical models,* including multivariable models, are used.

7. Students should demonstrate an understanding of, and ability to use, basic ideas of *statistical inference,* both hypothesis tests and interval estimation, in a variety of settings.

8. Students should be able to interpret and draw conclusions from standard output from *statistical software packages.*

9. Students should demonstrate an awareness of *ethical issues* associated with sound statistical practice.

The last two goals are new. They align with the increasing importance of these topics in statistical practice and public discourse. To make room for these new topics, a list of topics to omit or reduce in a first course was added to the main body of the document. In addition, the report has expanded appendices that provide multiple resources and examples to help instructors meet the *GAISE* recommendations and goals. The appendices focus on the following:

- Evolution of introductory statistics and emergence of statistics education resources
- Multivariable thinking
- Activities, projects, and data sets
- Examples of using technology
- Examples of assessment items
- Learning environments

The full report is available at *https://goo.gl/93XWyj*.

GAISE Committee Members

Robert Carver, Stonehill College
Michelle Everson (co-chair), The Ohio State University
John Gabrosek, Grand Valley State University
Ginger Holmes Rowell, Middle Tennessee State University
Nicholas Horton, Amherst College
Robin Lock, St. Lawrence University
Megan Mocko (co-chair), University of Florida
Allan Rossman, Cal Poly San Luis Obispo
Paul Velleman, Cornell University
Jeffrey Witmer, Oberlin College
Beverly Wood, Embry-Riddle Aeronautical University

Following the ASA endorsement of the report, the *GAISE* revision committee has focused on sharing the report with the larger community of statistics educators. Allan Rossman delivered a presentation at the November 2016 American Mathematical Association of Two-Year Colleges (AMATYC) meeting, and an ASA webinar presented by three members of the revision committee took place in December 2016 (*http://magazine.amstat.org/videos/education_webinars/GAISE2016.wmv*).

At the 2017 USCOTS, five members of the revision committee led two breakout sessions in which participants were given the opportunity to experience active learning with real data as part of a mini data fest. Each breakout session was broken into five groups, and each group worked with a different data set. The data sets focused on youth health, airline flights, lacrosse, missing children, and highway fatalities. Each group was asked to explore multivariate relationships within the data set and come up with examples of multivariate relationships that could be used in an introductory course. Participants used many platforms to explore the data, including R, SAS, Minitab, iNZight, Statcrunch, and TinkerPlots.

The five data sets used (including data dictionaries) and an overview slide for the breakout sessions can be found on the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE) website at *https://goo.gl/pSnM1h.*

On May 22, three members of the revision team and four panelists from community colleges (Monica Dabos, Joe Gerda, and Kathy Kubo from College of Canyons and Rebecca Wong from West Valley College) presented a joint webinar with AMATYC. The panelists answered questions such as "What do our current students need to be productive members in the workforce?" "How did the panelists get started making changes?" and "How can the new GAISE report help with change?" The webinar is posted at *www.amatyc.org/?page=webinars,* along with a copy of the slides.

An upcoming article in *CHANCE* magazine (*https://arxiv.org/abs/1705.09530*) gives more insight into the process of revising the *GAISE College Report,* includes more discussion about the key recommendations, and ends with some challenges for the community. ■

Megan Mocko is a master lecturer at the University of Florida. Her focus is teaching introductory statistics in multiple formats: face-to-face, hybrid, and online. She studies techniques to improve learning for students with learning disabilities and students in the online learning environment, as well as teaching with technology.

Michelle Everson is a professor and program specialist of statistics at The Ohio State University and former editor (2015) of the *Journal of Statistics Education.* Since earning her PhD in 2002, she has been teaching introductory and intermediate statistics courses. She is particularly interested in distance education and ways to actively engage students in online learning environments.

FUNdamental Engagement in Statistics Education

Lawrence M. Lesser, The University of Texas at El Paso

Larry Lesser is a statistics/mathematics education professor at The University of Texas at El Paso. He has written books and 100 peer-reviewed papers, done editorial service for *JSE* and *SERJ*, and won statewide/regional teaching awards. His work on mathematical sciences "fun" has yielded 75 published songs, a score of national contest awards, myriad conference performances and radio/TV appearances, several issues of *The Mini Page*, and five journal articles (see *www.math.utep.edu/Faculty/lesser/Fun.html*).

As John Tukey says, statistics folks enjoy getting "to play in everyone's backyard," so it's no surprise we enjoy various forms of play. Sometimes playful content-related entertainment (or, "edutainment") is showcased when the ASA celebrates a special anniversary (e.g., the recent 175th), when CAUSE A-mu-sing contest songs or videos are played at the United States Conference on Teaching Statistics (USCOTS), or when videos are displayed from a contest such as the ASA's 2011 "Promoting the Practice and Profession of Statistics" competition. The use of fun in statistics education also has implications for teaching, educating teachers, and educating the public.

Motivations

Given how important and interesting we know our discipline is, it may be hard to believe many of our students (especially our non-major students) have high levels of statistical anxiety that keep them from fully engaging in and embracing our course. In fact, statistics anxiety is fairly common in students and society. Education researchers have developed and validated two discipline-specific instruments to assess this—the Statistical Anxiety Rating Scale (STARS) and the Statistics Anxiety Measure (SAM). Fortunately, anxiety is more amenable than attitudes (which are considered more stable over time) to being changed by appropriate interventions.

One strategy several researchers have suggested for lowering anxiety (so students can devote more mental and emotional energy to learning) is selective introduction of material or moments incorporating fun. In a recent book chapter about statistics anxiety, I cite many conceptually oriented statistics books over the last few decades that employ humor, irreverence, or a mode such as cartoons to lower students' statistics anxiety. That said, there are many other methods of reducing anxiety, and reducing anxiety is just one motivation many instructors consider when deciding if or how to use fun.

The five top (by far) motivations my colleagues and I identified (in descending order of how often they were chosen on a survey of n = 249 USCOTS 2011 attendees, a 66% response rate) in our March 2013 *Journal of Statistics Education (JSE)* paper are: increases engagement; increases learning; makes teaching more enjoyable; reduces anxiety; and builds classroom community.

There's no doubt the inimitable Hans Rosling (who passed away in February) was enjoying and sharing a healthy dose of fun whenever he presented playful graphics and went into "sportscaster play-by-play mode" to narrate a data animation.

Forms

Fun comes in many forms, and my colleagues and I have compiled more than a score in our *JSE* papers—cartoons, celebration days, clothing, comic strips, food, games (commercial, cultural, or other), game shows, humor/jokes, kinesthetic activity, literature (e.g., short stories), magic, media bloopers, movies, music/songs/raps, poems, quotations, statistics fun books, strange news, striking examples, videos, and wordplay (e.g., anagram puzzles). Different forms of fun may have different interactions with students' learning styles and/or cultural norms, and our 2013 *JSE* paper indicated some interaction between form of fun and instructor gender: Male instructors were more likely than females to use humor, while females were more likely than males to use games.

Fun can also be classified by how much risk may be involved—ranging from low (e.g., prepared "safe" jokes, humor, and cartoons; pressing PLAY on professionally recorded song/video clips) to high (e.g., singing an original song or improvising humor). Whatever the modality and level of risk,

Figure 1a. A song from the CAUSEweb collection. *www.causeweb.org/cause/resources/fun/songs/what-p-value-means*

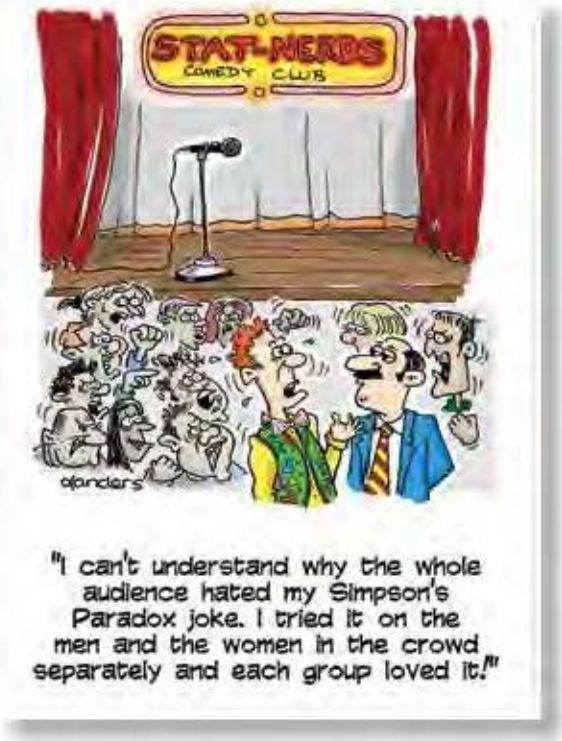


Figure 1b. A cartoon from the CAUSEweb collection. *www.causeweb.org/cause/resources/fun/cartoons/Simpsons-Comic*

the common denominator is that the fun uses characteristics of surprise, humor, or play (SHoP) in the service of education. By "in service to education," we mean the fun is connected to content in the course and not used as a generic distraction.

Sources

The discipline of statistics happens to have one of the most searchable, curated repositories of discipline-specific fun: the CAUSE fun collection at *www.causeweb.org/resources/fun*. Curated for more than a decade by Dennis Pearl of Penn State and me (with occasional input from many others), this collection is housed within the digital library of the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE) and is one of CAUSEweb's most-visited resources. The collection contains 718 (and counting) items spanning cartoon, art gallery, game, joke, magic, poem, puzzle, quote, song, story, and video.

An example of a song and a cartoon from the collection appear in Figures 1a and 1b. Also, the collection includes an introduction (organized by modality) to the literature on using fun in teaching statistics, together with lesson guidance on using fun items: *www.causeweb.org/cause/resources/fun/references.*

While the CAUSEweb collection is the largest and most searchable collection of fun items in statistics, it is certainly not the only source. For example, there is a collection of 200 statistics jokes, indexed by topic, compiled by the late Illinois State University Emeritus Professor of Psychology Gary Ramseyer and now maintained by his daughter, Vicki S. (Ramseyer) Morrow, at *http://my.ilstu.edu/~gcramsey/Gallery.html*.

Much activity on fun in statistics can be traced to the biannual United States Conference on Teaching Statistics (USCOTS). For example, the 2008 *JSE* review paper on fun came from an invited breakout session at USCOTS 2007, and the 2013 *JSE* paper started with questionnaires collected at USCOTS 2011 by a team of 11 authors, most of whom were in the CAUSE-supported Study of Fun cluster launched at USCOTS 2009. Beyond the cluster's joint work, many individuals have done their own work on fun:

- Shonda Kuiper's publications (e.g., November 2015 *The American Statistician*) and NSF-funded work on the use of learning through games (*http://web.grinnell.edu/individuals/kuipers/stat2labs/labs.html*)
- Mark Glickman's and my 2009 review paper (in *Model Assisted Statistics and Applications*) about using magic to teach probability and statistics and his USCOTS 2011 action footage
- Michael Posner's performance of statistical magic and song at USCOTS

- Pearl, John Weber, and I have received two NSF grants for preparing and assessing fun items (e.g., cartoons and songs) in the teaching of statistics.

Hesitations

Because some believe that fun has no "serious" role in the classroom, it is important to acknowledge and address common hesitations instructors may have, as my coauthors and I identified in the 2013 *JSE* paper, in descending order of how often the hesitation was chosen by the instructors surveyed:

- Can't quickly find good examples
- Uses too much class time
- No skills/talent
- Need to be perceived as serious by students
- Weak evidence of helping student learning
- Incompatibility with students' cultures
- Size of class
- Need to be perceived as serious by colleagues/supervisor

Many of these hesitations are readily addressed. Once instructors find out about the ever-growing user-friendly CAUSEweb collection, they can much more readily find good examples. If class time is a concern, an instructor can, for example, have a statistics song playing or a cartoon displayed as students enter or as papers are handed back, or it can be assigned to experience on a course webpage outside of class time. (The song in Figure 1a literally takes 10 seconds.)

The concern about fit with student culture (which applies not just to fun items but also, for example, to the context of data sets discussed in class) can be addressed with an initial survey (of student backgrounds and favorite bands, movies, etc.) and by making sure to avoid, for example, items whose humor comes at the expense of individual students or marginalized groups, or that unduly invoke or stereotype partisan politics, religion, sexuality, etc. In general, each instructor must reflect upon what dosage and modalities fit their personality, their course objectives, and the culture of their institution and students.

Most modalities work equally well in large classes as in small classes (in fact, a larger roomful of people can more readily yield a critical mass of people singing along to a statistics song). Special skill or talent is not needed when an instructor can, for example, simply press play on a video or song from the CAUSEweb collection.

By keeping the fun items connected to course content and not overdoing their frequency (e.g., education/humor researcher Avner Ziv found three or four jokes per class meeting to be an optimal dosage), the instructor should sufficiently maintain overall seriousness in students' eyes while increasing student engagement and attention. And citing some of the emerging critical mass of research on the use of fun can address the need for evidence and being taken seriously by colleagues.

Getting students involved in the creating or presenting of fun items can be a wonderful learning opportunity and community-building experience, whether done as a required or optional part of the course, and whether done as individuals or in teams. There are well-known examples of statistics educators who have had success with student-created items such as jokes (see John Wierman's piece in the August 2016 *The American Statistician*), videos, or cartoons (see Page 69 of the 2016 *Guidelines for Assessment and Instruction in Statistics Education College Report*, *www.amstat.org/asa/files/pdfs/GAISE/GaiseCollege_Full.pdf*). Often from the encouragement of their instructor, many students have submitted entries (song, cartoon, video, poem) to the biennial A-mu-sing statistics fun contest (*www.causeweb.org/cause/uscots/uscots17/a-mu-sing/rules*) or to the monthly blindly judged cartoon caption contest (*www.causeweb.org/cause/caption-contest/2017*) sponsored by CAUSE, and many of those student entries have won recognition or prizes.

Research

While it may sound surprising that there has been serious research on something like humor or fun, there are international refereed journals on humor research, and research on humor in educational settings actually goes back at least four decades. Our focus here, of course, is specifically on the context of teaching and learning statistics.

Because humor and fun are context-dependent, it is not surprising that some research in this area has had a focus on ecological validity and sustained duration. For example, Ziv reported in 1988 in the *Journal of Experimental Education* on a naturalistic experiment in which an instructor (trained in the use of educational humor) taught two sections of a semester-long introductory statistics course, in which the humor condition section (which had three or four jokes or cartoons inserted into each lecture) had average grades nearly 10 percentage points higher than the section with the nonhumorous condition.

Other studies are not comparative in nature, but focus on a better understanding of the role or dynamic of humor or fun in the course. For example, in the June 2015 *Transformative Dialogues*, Reynaldo Reyes and I reported on a case study of multiple sources of data from an instructor's introductory statistical literacy course. Findings revealed that students in this course valued, engaged in more, and felt they better understood the material when the instructor enacted a pedagogy that built on the emotional aspects of teaching and learning. Students' responses indicated it was more about the instructor's immediacy or delivery than the specific fun item/activity, and this is consistent with the findings of other researchers.

The reaction or direction of ensuing conversation after the insertion of fun into a lesson might differ in ways that set up additional content connections, and that trajectory can have ripple effects on the tenor of the rest of that day's lesson. Because of such challenges of having an instructor teach one section with fun and an otherwise identical, replicable control section without fun, some studies seek to remove the role of the instructor. Removing instructor variability has the secondary benefit of addressing the second most common hesitation on using fun mentioned by college instructors in our survey—namely, lacking skill/talent. In particular, researchers may conduct a student-randomized experiment in which the treatment group has fun artifacts inserted into an otherwise identical copy (e.g., of a reading, test, video, customizable open-source textbook, etc.).

In a 2006 issue of *Humor,* Ronald Berk and Joy Nanda report their randomized experiment with a graduate biostatistics of $n = 98$ students to assess the effect of adding humor to exam items, exam directions, or both on test anxiety and test performance. In a 2006 issue of *College Teaching*, R. L. Garner reports that 42 of 94 college students whose assigned three 40-minute statistics lecture videos had (three each) humor inserts gave significantly higher ratings of the lessons, how well the lessons communicated information, and quality of the instructor. They also recalled and retained more information on the topic (each $p < .001$) than did the 52 students who were randomly assigned to receive those videos without the inserts.

Asil Özdoğru and Robert McMorris in a 2013 issue of *Humor* reported that $n = 156$ undergraduates studied six one-page concept readings where three had content-related cartoons inserted and three did not. The inserts appeared to yield favorable student attitudes, but did not affect learning. David Neumann, Michelle Hood, and Michelle Neumann review other studies in their 2009 article in *Journal of Statistics Education.*

Findings revealed that students in this course valued, engaged in more, and felt they better understood the material.

In 2016, Pearl, Weber, and I published a randomized experiment in *Journal of Statistics Education* in which students (within several classes at a two- and a four-year college) were randomly assigned to either always receive or never receive a fun insert (e.g., cartoon, song, etc.) into each of a dozen otherwise identical readings within the course learning management system. Students exposed to song inserts performed an average of 7.7 percentage points better on the six related multiple-choice items embedded on exams ($p \approx 0.04$).

Our experiment's promising results with songs (relative to cartoons) and a conjecture that songs may offer more sustained engagement (e.g., due to having both visual and auditory channels of input, more mnemonic power, or inviting students to sing along) led us to explore using interactive statistics songs in which students supply concepts or context/examples (i.e., going beyond low-level recall) to be inserted (somewhat like Mad Libs) into a song that could then be played back to the student. This led us to our subsequent NSF grant (Project SMILES: Student-Made Interactive Learning with Educational Songs for introductory statistics) to create and field-test (with another randomized experiment) the effectiveness in enhancing learning and reducing anxiety of interactive songs spanning the introductory course.

A collaborative with professional expertise in both statistics and songwriting produced more than 20 songs high in aesthetic and pedagogical values, and the web-based platform allows auto-grading of student inputs. It is also useable in lecture, flipped, or online courses. When college students tried the first version of the SMILES-style songs in a lab, they thought the activity reduced anxiety and had benefits for learning the material. They also supplied feedback that informed the refinement of the intervention for a larger follow-up trial

Community

Well-chosen, well-placed statistical fun can be used effectively to build community in your classroom, in your department, or at your conferences. Nationally, there is also a community of kindred fun statistical spirits that always has room for newcomers. After all, it is important to make sure the study or practice of fun is not viewed as the domain of only those with rare talent or creativity. Opportunities to get involved include the following:

- Signing up to be a rater of existing CAUSEweb items and be rewarded for it in the CAUSE rewards program (*www.causeweb.org/cause/rewards*)
- Submitting a new fun item to Dennis Pearl at *dkp13@psu.edu* for possible addition to the CAUSEweb collection; it can even just be an idea for an item—for example, CAUSE has access to a professional cartoonist who can take an idea for a cartoon and manifest it with professional quality—or it can be a suggestion of a specific learning objective not covered by any item in the collection
- Joining periodic "fun folks" virtual or in-person gatherings, such as the Birds of a Feather lunch table at USCOTS this past May

now underway. Upon completion of the research study, the SMILES collection will be available on CAUSEweb for all instructors.

A nice feature of this innovation is that it should be readily transferable to other disciplines. Indeed, we are launching VOICES: Virtual Ongoing Interdisciplinary Conferences on Educating with Song. Primarily targeting STEM and health sciences, this forum debuts this month (September 27–28) and information about the program and registration is available at *www.causeweb.org/voices.*

Outreach

College statistics courses are often taught by faculty without a PhD in statistics who are housed in a variety of disciplines and departments. Thus, ways we develop to make statistics more understandable, relatable, and enjoyable can have that much more of an impact across a campus.

Fun can be used to make an impact even beyond a campus by helping popularize and humanize our discipline to broader audiences. There have been many recent outreach efforts in statistics, such as the ASA's *This* Is Statistics career awareness website (*thisisstatistics.org*) and campaign launched in 2014, the quinquennial World Statistics Day (inaugurated October 20, 2010, by the United Nations Statistics Division), or the World of Statistics website (the successor to the International Year of Statistics campaign of 2013). Such efforts often can or do employ bits of statistics fun to help attract and engage new audiences.

Statistical outreach can also happen within venues of mathematics organizations. The National Museum of Mathematics (MoMath), North America's only major mathematics museum, has a couple of hands-on exhibits with probability or statistics content (e.g., in Edge FX, a quincunx interactively explores binomial distributions and when they are approximated well by normal distributions) and has had statistics songs played at some of its events. Statistics played a role in most entries in the "QL in the Media" contest held by the MAA's SIGMAA on Quantitative Literacy (e.g., *http://sigmaa.maa.org/ql/contest2011.php*) and in many Media Clips columns in the NCTM practitioner journal *Mathematics Teacher*.

Statistical outreach can apply also to the mainstream media, such as the "Stats and Stories" podcast series (with 38+ episodes archived at *statsandstories.net*) sponsored by the ASA and Miami University. Communicating to an even larger, younger audience is an enjoyable departure from almost all of our usual work, forcing us to think about issues in the most accessible, big picture manner possible. I included some playfulness in an issue of *The Mini Page,* a weekly syndicated children's feature in 500+ newspapers with roughly 20 million readers. I wrote about statistics polls three months before the most recent presidential election. Also on that topic, I was the featured presenter (and lyricist) on a 2012 episode of the children's educational television show "Blast Beyond," which aired on a regional PBS station: *https://goo.gl/Gs1QWv.*

The thoughtful use of fun is a great way to make our subject matter accessible, engaging, and memorable to our students, as well as to promote and celebrate our discipline. ■

Expectations and Skills for Undergraduate Students Doing Research in Statistics and Data Science

Jo Hardin, Pomona College

As more statistics undergraduates participate in summer and capstone research projects, it becomes paramount for teachers to prepare them adequately for the experiences. Indeed, the most successful research students are those with both a strong understanding of foundational statistical methods and a fluent ability to wrangle data.

Undergraduate research has long been considered one of the strongest high-impact educational practices (*www.aacu.org/leap/hips*). However, there are myriad paths to successful undergraduate research, and there is scant information about how to link successful research practices to the undergraduate curriculum.

In recent years, the statistics and data science communities have come together to propose curriculum guidelines for undergraduate programs (*GAISE*, Statistics Guidelines, Data Science Guidelines). The suggestions are well thought out and meant to balance competing demands of time/units, student background, and existing curricular structure. The guidelines have been written to encourage modernization of standard curricula to catch up with new ideas being developed for the statistics and data science classroom.

Of course, one important aspect of any curriculum is to set goals for the graduates of that program. That is, what skills are necessary for students coming out of a specific statistics or data science program who will enter either the workforce or a graduate program?

Less common in current curriculum guidelines are details about how the pieces of the curriculum work together. In particular, we are concerned with how the course assignments and structure can support undergraduate research projects in statistics and data science.

Almost every summer since I began my faculty position, I have worked with students on projects related to my own research areas. Often, those projects extend into year-long senior thesis projects or repeated summer projects. I have published with my students as first author or substantial contributors in *Statistical Applications in Genetics and Molecular Biology, BMC Bioinformatics, Briefings in Bioinformatics, Environmental and Ecological Statistics, Computational Geosciences,* and *CHANCE.* Certainly, some projects have been more successful than others; indeed, there are plenty of projects that did not result in a peer-reviewed publication. A project's success often depends on factors unrelated to the curriculum (e.g., how conducive the project is to undergraduate exploration, whether the student is interested in the work, etc.) But most of the success of the project *does* come directly from the experiences the student has prior to starting the research.

Jo Hardin is a professor in the department of mathematics at Pomona College. Her work involves analysis of different types of high-throughput genetic data that don't conform to the usual assumptions needed for statistical analyses.

Skills

As we all know, doing research takes myriad skills. The skills below are all taught to some degree within a standard curriculum. I submit, however, that many skills which typically get less attention are among the most valuable for research.

Making an Argument

The most important skill for successful research is the ability to make a convincing argument. Making an argument requires there to be a novel idea and a method by which to argue the point. Students can often approach the problem in different ways: theoretically (e.g., mathematical proof), simulation, or via a literature review. Knowing that any given idea *can* be argued in different formats is surprising/illustrative for students. By understanding there are different creative ways to solve a problem, they are given the freedom to harness their own skills and comfort with the research project.

One of my recent projects involves creating prediction intervals for a random forest model. The novelty comes from the derivation of the appropriate standard error. There are a handful (not many) of papers on the topic, a few very theoretical papers, and

a few that approach the problem in a different applied way. My student and I have had to work through *how* our ideas add to the literature and *how* those ideas can be synthesized into an argument. Our conversations circle back repeatedly to "what are we trying to argue, and how can we argue that effectively?"

The classroom is an ideal place to demonstrate that there is almost never only one solution or argument to a problem. A simple comparison of mean versus median hypothesis testing shows two tests can address the same underlying scientific hypothesis. Simulation studies (e.g., to determine coverage rates for different bootstrapped confidence intervals) give a way of understanding a theoretical outcome.

The curricular aspect to making an argument relies on the professor continuing to ask a student "how do we know that?" or "how can we argue that one test is better than another?" Students are often so caught up in the weeds of learning the techniques that they fail to reflect on the process by which the method was developed or by which it has become popular.

Engaging with Theory

The theoretical underpinnings of statistics have long been a cornerstone of most undergraduate programs. Certainly, my most productive research experiences have been those done with students who have strong knowledge of undergraduate topics such as probability theory, distribution theory, maximum likelihood, and regression modeling. And although some of my projects have built on those theoretical constructs, it is the intuitive theoretical grounding of core principles in statistics (e.g., sampling distributions, interactions) that are imperative to a successful research project. Indeed, whether a student can derive a particular moment-generating function is much less important than whether they understand that knowing every single moment of a distribution uniquely defines that distribution.

A solid theoretical background builds not only strong intuition, but also an ability to read the literature and place the research in a larger framework of knowledge. With undergraduates, I do not try to prove results with measure theoretic tools. Instead, I often work with the students to simulate scenarios and gain an understanding of what others have done within that more theoretical framework. For the students to have new insights, they must be able to understand the general structure in which their work resides.

A recent project used canonical correlation analysis to identify correlated *pairs* of linear combinations of variables. The setting is sufficiently complicated that it would be difficult to find the theoretical distribution underlying each correlated linear combination (keeping in mind that each pair is also correlated with other pairs), but the analysis is not useful unless there is a way for the practitioner to know whether a large correlation is actually statistically significant. We were able to derive a permutation algorithm to define significance (the method also doubled as a way to measure false positive and false negative rates). The permutation method, however, was not trivial to implement, and it required the students to understand how the distributional aspects are determined by both the linear combinations and the complex correlation structures.

I suggest that many theoretical statistics and data science courses are already providing the needed background to make a student researcher successful. However, when teaching, for example, the Neyman-Pearson lemma, the intuition behind how we know what we know (and why it matters) is vastly more fundamental for the students' future research capabilities than the detailed steps of the proof.

Working Independently

There is likely no question that a student's ability to work independently is imperative for a successful research project. As busy advisers, a needy student can be an inordinate drain on our time. And if we are providing guidance at every step, then we might as well be doing the research ourselves. (One way to cut down on contact hours is for a pair or trio of independent students, who can be even more successful than an individual, to work together on a successful research project.)

While absolutely important, one might argue that a student's ability to work independently is not something that can be taught in a standard curriculum. I disagree. By providing the student with both *practice* working independently and time to *reflect,* all students can learn to generate their own ideas in a productive way.

I encourage all upper division (and I dare say lower division) statistics and data science courses to contain project-based assignments with some degree of autonomy. That is, the project should have as one of the assigned tasks a directive for the student to do something independent (e.g., teach themselves a twist on a topic already covered in the course). Admittedly, projects can be time consuming to grade, especially in large classes. However, there are structures and tools to make projects more attractive

for the instructor. For example, working in groups cuts down on the number of projects to grade, and peer assessment gives the students a sense of what other students have created. Also, such an assignment has the added benefit of allowing you to use it on letters of recommendation. I sometimes provide details about the topic a student has learned and communicated independently.

GitHub and GitHub Classroom are resources that streamline both group work and assessment and are nevertheless valuable skills for statistics and data science students. Additionally, Jenny Bryan has put together Git resources that are streamlined and easy to follow.

Along with doing the project, another aspect to developing independent research is providing structure for the student to reflect on their work. For any assignment (project or other), the student should be able to express *what* they did, *why* they did it, and what the *next* step should be. Reflecting on what they still do not understand can be incredibly valuable. One professor I know requires his students to reflect via a Google form with a mechanism running in the background to inform him if they don't do it!

A quick reflection on a notecard or as part of the end of the assignment teaches the student to deliberate on what they have done and to think about the next steps in the process. A strong research student will come to your meetings with both work accomplished and ideas for moving forward. The process by which they generate ideas for moving forward is not innate and can be learned through repeated practice.

Wrangling Data

I have included data wrangling as a core skill because it is increasingly important to almost every research project I see (in my group and in others). Indeed, even the theoretical projects on which I am involved often use examples that require substantial data wrangling. Additionally, I continue to see data wrangling as a core tenet that is overlooked in many curricula.

Working with data is the only way to get good at working with data. Our students should be graduating with a fluency in programs like the dplyr R package. It is not only a vital aspect of having a successful research project, but it is the key to a successful career in any data-related field.

Practice in data wrangling should come early and often, and the swirl R package and DataCamp platform use interactive tools to get students started. Requiring good data wrangling skills in your courses will benefit you and your students in the long run.

Further Reading

Curriculum Guidelines

- High-impact educational practices suggested by the Association of American Colleges and Universities, *www.aacu.org/leap/hips*
- *GAISE Guidelines for Assessment and Instruction in Statistics Education (GAISE)* Reports, *https://goo.gl/93XWyj*
- Curriculum Guidelines for Undergraduate Programs in Statistical Science, *https://goo.gl/rfVzx8*
- Data Science Guidelines, *www.amstat.org/asa/files/pdfs/EDU-DataScienceGuidelines.pdf*

Working Independently

- Projects that are a high-impact practice as defined by the Association of American Colleges and Universities, *www.aacu.org/leap/hips*

Resources for Both Group Work and Assessment

- GitHub, *https://github.com*
- GitHub Classroom, *https://classroom.github.com*
- Jenny Bryan's Git resources, *http://happygitwithr.com*

Practicing Data Wrangling

- Dplyr R package, *https://cran.r-project.org/web/packages/dplyr/index.html*
- Swirl R package, *http://swirlstats.com*
- DataCamp platform, *www.datacamp.com*

Successful Research(ers)

I've structured this article to focus on the learning goals associated with curricular choices to produce strong researchers (and new members of the workforce who can deal with the complex challenges they will face in a world full of data). There are many other choices a student makes along the way that can contribute to a successful research project. For example, engagement in a field outside of statistics and data science can generate excitement for solving a particular applied research project. Or working with new software programs (e.g., the quo function in dplyr version 0.7.1 as of June 22, 2017) can give the student a sense of being part of a larger community of statisticians and data scientists.

Alas, the most important aspect of successful research is the degree to which *you* are excited about the project. If you love what you are doing, the student will sense that and be just as engaged. So, if there is something you want to work on, I implore you to assign an undergraduate student to the project, regardless of their background or the curriculum from which they come. ■

Participants in 2017 ASA DataFest at Duke University

DataFest Shows Spike in Growth, Provides Immersive Experience

Mine Çetinkaya-Rundel

Mine Çetinkaya-Rundel is the director of undergraduate studies and an associate professor of the practice in the department of statistical science at Duke University. She earned her PhD in statistics from the University of California, Los Angeles, and BS in actuarial science from New York University's Stern School of Business.

For the last few years, spring has meant ASA DataFest and being immersed in a huge amount of data for thousands of college students. In a nutshell, DataFest is an annual 48-hour competition in which teams of undergraduate students work to reveal insights into a rich and complex data set. The data set is kept secret until the start of the competition, so students have no means to prepare for the contest.

Teams of up to five students compete over the weekend and are challenged to summarize their approach and findings in a four-minute presentation comprised of just three slides at the end. The students present their findings to a panel of judges for prizes in categories such as Best Insight, Best Visualization, and Best Use of External Data.

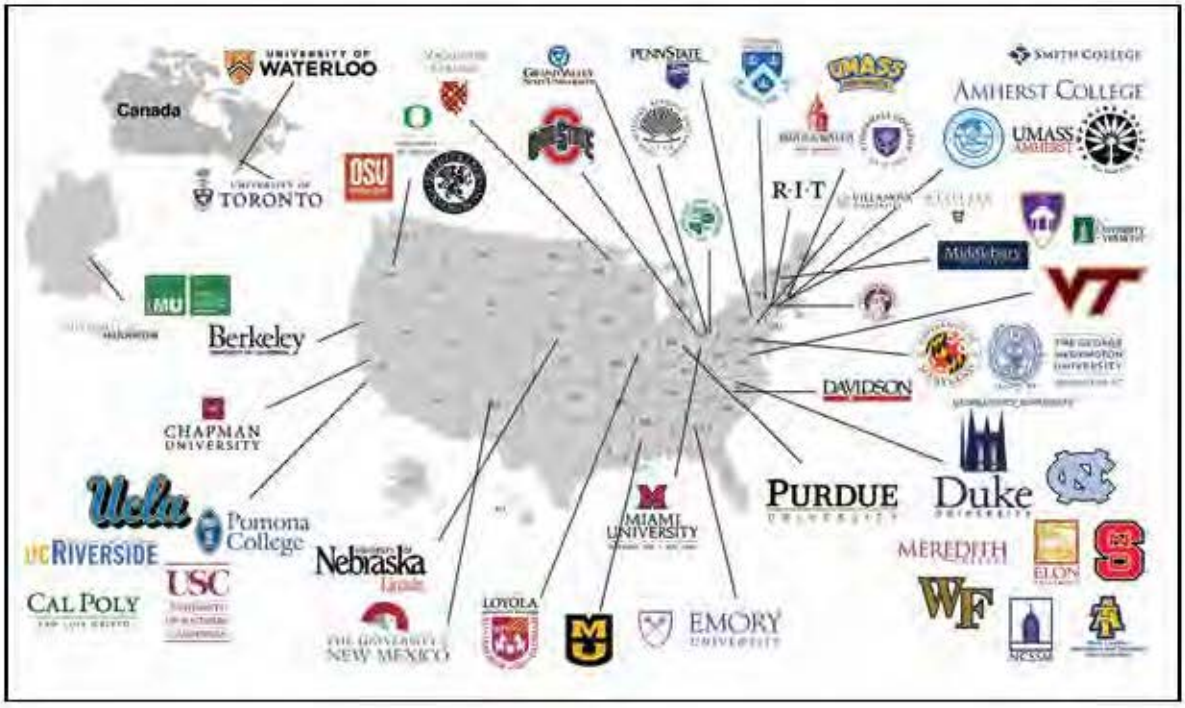
This extra-curricular immersive experience provides a medium for students to interact with large amounts of data without the constraints of the classroom.

ASA DataFest is a competition, but a friendly one. The mood is light, food and prizes are given out throughout the weekend, and students are encouraged to share ideas. The competitive nature of the event gives students a goal to work toward and keeps the teams motivated. The event also provides an opportunity for students to engage with analysts, statisticians, and data scientists from both the business and academic realms who serve as consultants.

Aside from being fun for the students and a good way to promote the discipline, DataFest serves multiple important curricular purposes. It brings students across all levels of the curriculum together, blending first- and second-year students with juniors and seniors. Participation from various majors also fosters interdisciplinarity. DataFest fills gaps in the curriculum that are otherwise difficult or impossible to discern based on traditional classroom experiences and assessments.

History of ASA DataFest

The first DataFest was held at the University of California, Los Angeles (UCLA), in 2011. In 2012, the event grew to also include Duke. In 2013, UCLA expanded their event by hosting students from Pomona College, the University of California, Riverside, Cal State Long Beach, and the University of Southern California, while Duke also hosted students from the University



Institutions participating in the 2017 ASA DataFest. An interactive visualization of growth of the ASA DataFest over the years can be found at *http://bit.ly/df_growth.*

of North Carolina and North Carolina State. In 2015, the ASA became a sponsor of the event, which was officially renamed to ASA DataFest. Participation has continued to grow since, both in terms of number of institutions and number of students. In its first year, 30 students participated in the event; in 2017, that number grew to more than 2,000 from 31 institutions.

Each year, the data and challenge are different, but the common theme is making sense of Big Data—specifically data that are larger and more complex than what students are used to seeing in class.

2011: Every arrest in Los Angeles from 2005–2010. That is almost 10 million geotagged police reports provided by the Los Angeles Police Department (LAPD). The officer-in-charge of the LAPD Strategic Crime Analysis Section presented the data to students and challenged teams to suggest policy changes that could improve public safety.

2012: Microfinance, with data provided by Kiva.org, a nonprofit organization that brokers micro-loans internationally. The challenge was broad. Kiva wished to know what outsiders would find interesting and useful, so invited the teams to discover any insight or association they thought meaningful for either lenders or lendees.

2013: Dating, or more precisely online dating, with data provided by eHarmony. The data consisted of approximately 1 million "user-candidate" pairs as suggested by the eHarmony matching algorithm. These data also included more than 200 variables with information about ideal characteristics in a partner, how important these characteristics are, "words friends would use to describe you," etc., as well as a measure of success of the suggested match: whether the matched pairs contacted each other.

2014: How customers of GridPoint, a company providing energy management and sustainability solutions, can best save money and energy. The energy data provided by the company was augmented with supporting climate and location data.

2015: Detecting insights into the process of car shopping with website visit data provided by Edmunds.com.

2016: Investigating how site visits can be converted to ticket sales and how TicketMaster can identify "true fans" of an artist or band. Data were provided in three tables that could be matched by common fields, which presented a challenging but rewarding data wrangling problem for students.

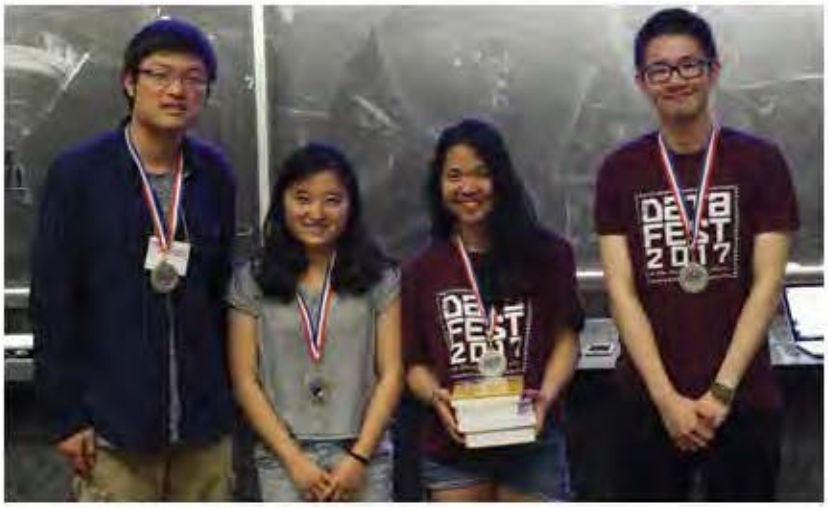
More information about each year's data set can be found at *ww2.amstat.org/education/datafest/previous.cfm.*

MORE ONLINE
More information about each year's data set can be found at *ww2.amstat.org/education/datafest/previous.cfm.*

ASA DataFest 2017

This year, the motto was "let the data take you places" and the data was provided by Expedia.

Students are hard at work during the 2017 ASA DataFest at Duke University.


Team P.H.A.S.S—winners of the best insight award—are recognized for their deep insights about differences in clicking and booking behavior between US and German Expedia.com customers.

com. Many students mentioned that they have been on Expedia.com as they look for tickets between home and school, so they were thrilled to get their hands on data they may have generated. The data consisted of two files: a primary data file of more than 10 million records and 27 variables and a destination file with more than 32,000 records and 19 variables. These records were from a sample of registered Expedia.com users from the United States, Canada, and Germany who had either clicked on or booked a hotel in 2015. One potential goal was to model users' browsing and clicking behavior to determine whether they will book a hotel; however, many students explored geospatial and temporal patterns in travel preferences.

The event at Duke University started with a small group of just more than 20 students in 2012. This year, more than 340 students from seven universities (Duke, The University of North Carolina, North Carolina State, Meredith, Elon, North Carolina A&T, and Wake Forest) and one high school (North Carolina School of Science and Math) took part. This is a huge spike in growth, almost all thanks to past participants promoting the event to their friends and the data providers who help come up with exciting and relatable challenges each year.

Looking Forward

ASA DataFest is a data-centric educational tool that allows students to learn by doing. The breadth of the challenge shifts the focus from the search for the "right" answer to becoming creative with data. The complexity of the data set provides an opportunity for students to sharpen their ability to manage, clean, and explore data in addition to scaling models and other statistical approaches they have learned in their classes. The limited time frame of 48 hours coupled with the difficulty of the challenge allows students to appreciate the value of teamwork, which is something students often push back on in classroom settings.

If you would like to join in or help organize a local ASA DataFest, see *ww2.amstat.org/education/datafest/hosting.cfm* for useful resources. ■

If you would like to join in or help organize a local ASA DataFest, see *ww2.amstat.org/education/datafest/hosting.cfm* for useful resources.

Great Young Society II: Preparing Our Youth Today for the Workforce of Tomorrow

Seated: Whitney York, Jesse Chittams, and Cody Griffith; standing: Raul Torres, Ezra Connell, Olek Gierczak, and Mary Miller

One of the most pressing challenges facing our youth today is the lack of knowledge of, and inroads into, some of America's most promising career opportunities for the 21st century: science, technology, engineering, mathematics, and data science (data management, Big Data, informatics).

Great Young Society II [501(c)(3), *www.greatyoungsociety.org*] was formed in 2001 by Jesse Chittams to address this challenge. Its mission is to prepare the youth of today for the workforce of tomorrow. A primary goal is to increase awareness of career opportunities in various STEM professions among students. Specifically, through support from tax-deductible gifts, grants, and donations, the society supports scholarships, workshops, hands-on research experiences, and technical training in data management and statistical consulting.

Society members visit classrooms throughout Philadelphia and the Washington, DC, area and provide career seminars and hands-on training in data science, as well as advice for navigating the college admissions process by providing SAT preparation assistance.

The society's workforce readiness program provides year-round internship opportunities to undergraduate- and graduate-level students who have a desire to gain marketable experience in statistics, computer programming, data management, informatics, and biomedical research studies. Specifically, it offers students hands-on skills with data collection using REDCap and Qualtrics and data analysis using SAS, SPSS, and STATA.

Much of the success of this initiative can be credited to a collaboration with the University of Pennsylvania, but society leadership hopes to expand to other institutions. After only a few months of training, interns have typically been able to secure permanent positions at institutions such as Eli Lilly, the US Centers for Disease Control and Prevention, contract research organizations, and the University of Pennsylvania.

Recently, the society collaborated with the ASA Committee on Minorities in Statistics to help support their annual JSM Diversity Mentoring Program (*http://community.amstat.org/cmis/events/dmp2017*) and StatFest (*http://community.amstat.org/cmis/events/statfest*). ■

MORE ONLINE
Find out more about Great Young Society at *www.greatyoungsociety.org.*

Dear Teacher,

Abigail Kirchman is a Math for America Master Teacher in New York City. She teaches at a transfer high school, The James Baldwin School, which is affiliated with the New York Performance Standards Consortium and NYC Outward Bound. In addition to the course Misleading Statistics, Abigail enjoys teaching classes such as Probability and the Lottery and Islamic Art and Geometry. Contact her with questions and ideas at *@abbykirchman*.

What will you do when a student asks you for a pencil? This question was first posed to me at the 2010 Minnesota Spring Mathematics Conference in Duluth, Minnesota. "Really?" I thought, "We drove three hours and gave up our weekends to learn about this?" I wanted to have real teacher debates about the philosophy of learning. I wanted new activities I could use in the classroom tomorrow. But as the conversation began, I saw there was plenty to think about.

You could ask the student for collateral … a shoe, for instance! Buy boxes of golf pencils—cheap—and guarantee a return. Refuse to give pencils—teach natural consequences. Require students to ask a friend—build collaboration. All these options for what is ultimately a split-second decision that, without a plan, can happen in every hour of every school day.

We all spend hours planning every week and make hundreds of in-the-moment decisions (in front of classrooms full of teenagers, no less). I sometimes find myself thinking, "What should I focus on? What matters? What decisions are the most effective? Most sustainable? Most important?" Answers vary.

Additionally, many of us teach in schools driven by test scores, where we are evaluated on our students' ability to correctly bubble in an answer sheet. When this is your context, it is difficult to remember that successful teaching is not defined by high test scores. So, what, then, do we focus on to create a space where, as Socrates encouraged, students can examine their own lives? What takes precedence in our long list of conflicting priorities?

Connection—between students, colleagues, and with the content we teach—must come first.

We must connect with our students. Our students thrive on real relationships. Notice a student in a genuine way and you have a connection; do this three times and you will have a relationship. It's a formula, and formulas only go so far. Being in the mindset of noticing, however, allows us to think about relationships and remember the humanity of the students we teach.

I used to think knowing my students meant learning their names and something about their math ability. A solid seating chart and a good diagnostic will do the trick. But my students taught me otherwise. We have to take the time to see when someone is not feeling well or is tired from work the night before. It's our job to listen to the anxiety our students experience in a math classroom and to process the feelings of frustration during problem solving to support them in learning.

To set the tone, my first assignment is for students to write a letter that describes their math story, hopes, goals, and the information they think is important for me to know about them. It may seem counterintuitive. We have so much content to teach; how can we take this time away from the math? However, connecting with students is a necessary investment in their learning; before anyone can learn, they need to trust the people around them and feel safe.

We must create opportunities for students to connect with each other. Too often, students at the end of a semester in my class don't even know each other's names. I'm working on it, and it's important to work on because a class is a community of learners.

This doesn't mean we have to throw out individual think time or force groupwork. Rather, we have to continue to think about ways to build relationships between students. It's so human. I'm much more likely to go to a professional development [opportunity] where I know someone versus one where I am alone; I'd prefer to be at a party with my friends than with all new faces.

In the classroom, I am trying to use seminar structures that require students to use each other's names and recognize each other's ideas. I also use and create tasks with roles in which students must depend on each other to be successful. Additionally, think-pair-share and other discussion protocols support student conversation in a nonthreatening manner.

When we give students structures within which to work, we enable them to interact with safe social expectations and avoid awkwardness. People feel comfortable and are able to focus on learning and inevitably build community. It's our job to create this environment, where all students are accepted and can take the risks necessary to learn.

We must connect with our colleagues. Being a good teacher requires connecting with our colleagues in addition to connecting with our students and supporting spaces for them to connect with each other. Just like our students, we need support and community to empower our students.

The traditional image portrayed of our career is that of the individual teacher alone in the classroom. But lone teachers cannot fully support a classroom of diverse learners. Today, we have the benefit of various learning experts in the form of special education teachers, English as a new language teachers, social workers, and paraprofessionals. Each of these educators can lend a different viewpoint to our students and our work.

By listening to other's perspectives, I have learned how to shift my classroom structures to be more accessible, equitable, and inclusive. My colleague called to my attention my grading system, which penalized students doubly for not understanding concepts. He helped me develop a new system focused on content mastery. Students began to talk about their growth in terms of learning targets, rather than meaningless percentages. In the new system, students can attempt to show mastery

on learning targets multiple times and in a variety of ways. Now, their grade is linked to the learning. A small shift in my thinking, in collaboration with a colleague, made a substantial difference in the communication between my students and me and their confidence in their ability to learn.

Connecting with our math departments provides another invaluable space to improve our practice. In my math department meetings, we spend time analyzing and revising tasks, building and trying structures, and visiting each other's classrooms. Together, we can diagnose and address misconceptions and concerns related to the mathematical understandings of our students. When we noticed students were struggling to verbalize their thinking, we modified a double-entry math journal to help them record reasoning during and after problem solving. The tool supported students in communicating their ideas.

One student in particular comes to mind. This student had presented her final paper to a panel of three evaluators and failed. We knew she understood the concepts, but her explanations were incomplete. To prepare her for the revisions, we gave her the double-entry math journal to organize her thinking. The difference between her initial communication of ideas and her revisions using the tool was phenomenal! She shared that she felt finally able to express her mathematical thought.

Our departments enable us to mathematically support our students in a way that is specific to our own settings. Without these teacher-to-teacher connections, we miss out on opportunities to improve the learning and success of our students.

When participating in interdisciplinary planning, colleagues from other content areas will often suggest statistics: "Can't you relate some stats to that? You could teach the stats around …" Our colleagues are right! *Statistics is inherently connected to a wide range of content, specifically with regard to issues relating to our students' lives.* Unlike algebraic fractions or asymptotes, statistics lives in a context, and students should never have to ask how our class relates to their lives.

With our current access to data, connecting students with content is easier than it has ever been. In my Misleading Statistics course, students receive data from their own city. They consider what may be related—perhaps average death age and smoking rates in neighborhoods in the Bronx? Or percentage of population with a high-school degree and average salary across Brooklyn? Students select data for real questions they have. Does high school really have an impact? How bad is smoking? As they work through their statistical analysis, students are engaged in their own questions and their own data. Through this work, they are truly statisticians. I don't know the answers any more than they do, which sometimes feels uncomfortable as the "teacher," but, together, we learn about the world through the perspective of statistics.

In our post-NCLB [No Child Left Behind] era, there is also no shortage of data within our schools. My students' final statistics project was to analyze data within their community by studying attendance and grades in various classes. In our transfer school setting, many of our students struggle with attending class due to health issues, family concerns, and, sometimes, motivation.

We asked, "What is the relationship between being in school and achieving academically as measured by grades?" Students worked in teams to study different class periods throughout the day. Using anonymous student data and Desmos—a free online calculator—students modeled the data, represented it graphically and algebraically, and analyzed the correlation. As many students had correctly predicted, they found attendance to be highly correlated with grades.

After revisions and edits, students presented their findings to our attendance team—a group of administrators, social workers, and support staff—which developed a dialogue between students and faculty. This gave students voice and ownership in a conversation that otherwise can feel artificial and imposed. Unlike previously, we weren't talking about students in a closed-door room; rather, we included them in the conversation as part of the community.

Connecting All Around

In my efforts to connect, I often fail. Sometimes, I make wrong assumptions about contexts that will relate and topics that will motivate. I'm normally about two years behind the trends (I finally learned about Snapchat!), and my contextual references can fall flat.

Finding what truly connects to students requires careful and constant listening. Only by connecting to our students can we find the math that connects to their lives. To that end, it's not just okay—but necessary—for us to ask our students questions about what is relevant and interesting to them, especially in our ever-shifting culture. We should build in time to understand what students are thinking about and bring it into our classrooms.

Teaching is a privilege; it is also extremely difficult. The first years, in particular, present an exhausting amount of social and emotional thinking, as well as the challenge of creating learning spaces for many learners at the same time. Sometimes, it seems impossible and we lose our own sense of humanity in bathroom-less days and late nights.

Teacher dropout rate is a real concern, and so we also should consider what keeps us well and in the classroom. *As we work to connect with students and content, we naturally connect to the work.* Among the many decisions—from pencils to grading systems to content—it is convenient that, by prioritizing the connection with students and content, we are sustained and motivated to continue. By connecting, we too remain connected.

With the beginning of a new school year comes a fresh start. Don't stop at the seating chart and textbook. Get to know your students and find content that connects to them.

Best of luck, Abby

STAT*tr@k* is a regular column in *Amstat News* and a website geared toward people who are in a statistics program, recently graduated from a statistics program, or recently entered the job world. To read more articles like this one, visit the website at *http://stattrak.amstat.org.org.*

Q&A with educators

We interviewed a few statistics teachers to find out who inspired them, where they get their best teaching tools, and what they think is the most challenging part of being a teacher. To read the full interviews, visit *http://magazine.amstat.org.*

Amy Hogan

Statistics and Math Teacher
Math for America Master Teacher
Twitter: @alittlestats
Blog: A Little Stats (*http://alittlestats.blogspot.com*)

What level of education do you teach?
I teach AP Statistics and other math classes in a specialized public high school.

Where do you teach?
Brooklyn Technical High School in Brooklyn, NYC.

What or who inspired you to become a teacher?
When I was a math major in college, I said I never wanted to teach, but I changed my mind once I got a taste. Prior to teaching, I worked as an actuarial analyst. I took on a training role in my company and quickly realized I really enjoy helping other people learn.

Can you describe your day-to-day life as a teacher?
An average teaching day for me: subway to work, teach AP Statistics classes, meet with colleagues for mentoring or common planning, coach my math team, grade and/or lesson plan after school, subway home, go to Pilates class, and then relax with a nice dinner at home.

What has been your most satisfying teaching experience?
The greatest reward, in general, is when my former students tell me about the math and statistics they're learning in college or doing in their careers. Recently, a former student visited and said, "This semester in college, I derived the Central Limit Theorem using a Fourier transform. So cool."

What is the most challenging part of being a teacher?
The politics. The negative impact of reduced budgets, changing curricula, and outside influences are becoming more and more of a reality for public high-school math teachers, especially.

How is teaching today different than it was when you first started?
The biggest difference I see is the growing number of open source and open access materials. The increased availability of these resources is especially helpful for public school teachers because it means they can do more with their often-limited resources. Less reliance on cost-prohibitive materials is a win for everyone, sure, but it's imperative to increase equity in math and statistics education.

What advice would you offer someone who is just starting their teaching career?
New teachers should make sure to find a community of teachers, in their school or elsewhere. I would not be where I am today without the help of very supportive colleagues.

What do you enjoy doing in your spare time?
I am learning R/RStudio, and it's been a lot of fun. I also love to travel. I enjoy finding great local places to eat and drink in my travels as well as at home in New York City.

You have a great blog, A Little Stats, that offers resources for statistics teachers. Do you recommend any other blogs or books?
Too many to list here! You can see my stats faves on my blog (*http://alittlestats.blogspot.com/p/things-loved.html*). In general, one of the best resources for AP Statistics teachers is the AP Statistics Teacher Community (*https://apcommunity.collegeboard.org/web/apstatistics*).

Where do you get your favorite lesson plan ideas? What is your favorite teaching resource?
My favorite source of statistics teaching ideas comes from other statistics teachers and professors. The network of stats teaching friends via the AP Statistics community, conferences, and Twitter is an endless source of inspiration for me. ■

Michelle Everson

Professor and program specialist of statistics at The Ohio State University

What level of education do you teach?
I teach at the college level.

What or who inspired you to become a teacher?
My biggest inspiration to become a teacher was Joan Garfield. I started working as a teaching assistant for Joan during the second year in my PhD program at the University of Minnesota, and that experience changed my life.

I wasn't sure at that time what I wanted to do once I completed my degree. I was shy and introverted. The thought of being a teacher and standing up and talking in front of other people on a daily basis scared me to death. Joan opened my eyes to a world I was unfamiliar with, and her support and encouragement gave me a much-needed boost in confidence. She showed me that activity and discussion have a place in the statistics classroom, and she changed my ideas about teaching and learning. She introduced me to research and scholarship in statistics education and to a whole community of statistics educators.

Joan was one of my biggest cheerleaders while I was a graduate student, and she continued to be a mentor to me after I received my degree.

Can you describe your day-to-day life as a teacher?
Typically, I teach one face-to-face section of our statistical literacy course, and I also teach the online section. I also serve as the coordinator for the course, and this involves supervising 12 or more graduate teaching assistants and lecturers per semester. I'm ultimately responsible for all the students and teaching staff who work with the course, and we often have between 900 and 1,100 students taking the course per semester.

I would say a good chunk of my day-to-day life involves trying to keep up with email! On a daily basis, I generally receive

several messages from students, teaching assistants, or lecturers about various course-related issues. I have a weekly meeting with our teaching assistants to talk about what is going on in the course and to plan ahead for future assignments and activities, and it's not uncommon for teaching assistants to stop by my office at various times each day to ask questions or share some of their experiences. There are two days each week when I have regular office hours, and students from our course might stop in then as well to get extra help or talk about concerns.

I always like to try new things each semester and revise my course materials, and that takes some time each day. I update my lectures with new and timely examples, and I make adjustments to lab activities and homework assignments based on how these assignments worked during the previous semester. Sometimes, I might attempt a new activity from scratch if we begin to notice our students are struggling with particular ideas and need extra practice with certain concepts. I would love to get to a point where I have all assignments and lectures ready to go at the start of the semester, but I'm usually tinkering with things a little at a time throughout the semester.

If I'm not in the classroom or checking in with my online students, I'm usually planning ahead and trying to stay on top of things. Another part of my job involves handling some of the staffing in our Mathematics and Statistics Learning Center (MSLC). This is a place where students can go throughout the week to get extra help from our graduate teaching assistants with the content in many of our statistics courses, and there are often little things I have to take care of on a regular basis related to the MSLC.

This coming autumn, I will also be serving as a faculty mentor in a special OSU program called the Second-Year Transformational Experience Program (STEP, *www.step.osu.edu*). Through this program, I will work with and meet regularly with a cohort of approximately 15 second-year students, and I'm excited to be able to learn more about their interests and concerns and help guide them through part of their college journey.

What has been your most satisfying teaching experience?

I think I get the most satisfaction when former students get in touch with me, out of the blue, to tell me about experiences they've had that remind them of content they learned in my course or to tell me about how much they are using information they learned in the course.

Just recently, a former student stopped by my office to talk about his plans for graduate school, and he told me he is now seeing a lot of what we talked about in our statistics course in journal articles he is reading in his field of study. Another former student sent me a bad graphical display she noticed in a news report because she thought I would appreciate it (and it was a good one).

For me, it is such a wonderful feeling when I can tell students are seeing the value in what we are trying to share with them, even if they might not totally get it until well after the course ends.

Where do you get your favorite lesson plan ideas? What is your favorite teaching resource?

Honestly, I get lots of ideas from reading news reports and listening to news radio! I have a long commute to campus, and I often listen to the news as I'm driving. Several news stories have made their way into my lectures and assignments.
I have also found lots of great ideas on the website for the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE, *www.causeweb.org*) and within the *Journal of Statistics Education* and the journal *Teaching Statistics*. Other great resources are my peers; lots of lesson ideas have been born simply by bouncing ideas off of colleagues.

What is the most challenging part of being a teacher?

The older I get, the more out of touch I sometimes feel where my students are concerned. I gasp each year when I read the new Mindset List from Beloit College *(www.beloit.edu/mindset)*, because the world our students are now living in seems so different from the world I grew up in. I don't always know what interests my students have, or what types of obstacles they are facing as college students, and I am constantly trying to figure this out so I can do a better job when it comes to engaging and motivating these students.

I teach a course that students have to take, and many of the students don't necessarily want to be taking the course or see the point of the course. I honestly think that is one of the biggest hurdles I face as a teacher. I work hard to try to get to know my students and find out more about them so I can bring more engaging and relevant examples into the classroom. Finding new and innovative ways to excite and inspire students is definitely a challenge, but it's one I've enjoyed trying to tackle. ■

Katherine Halvorsen

Professor, Smith College, Northampton, Massachusetts

What or who inspired you to become a teacher?

My mother and her aunt were both teachers. It felt to me like the "family business."

Can you describe your day-to-day life as a teacher?

Teaching classes, meeting with students, serving on committees—both at the college and for the ASA—and working on research projects—alone and with students.

What have been your most satisfying teaching experiences?

Watching students develop mastery in my courses and reading a student's comment that projects are so much easier when they hand in intermediate reports on a regular schedule, rather than do everything in the last few weeks of the course!

What is the most challenging part of being a teacher?

Teaching students the importance of planning ahead for getting their work done, of showing up prepared, and of working out a plan with me when they can't do these things.

How is teaching today different than it was when you first started?

Statistics is now a required course for almost all STEM students and many liberal arts majors. It was not a required course when I started teaching. Only curious math majors and some adventurous biology majors took the course.

What advice would you offer someone who is just starting their teaching career?

Join the Statistical Education Section of the ASA and become a grader for AP Statistics. Both groups offer a lot of help to newcomers and experienced teachers.

What do you enjoy doing in your spare time?

Reading, hiking, and traveling.

Name one or two favorite blogs or books you have read and would recommend to others.

James Lang's *Small Teaching: Everyday Lessons from the Science of Learning.*

Where do you get your favorite lesson plan ideas? What is your favorite teaching resource?

I read a lot and talk to other teachers. ■

Mark Ward

Associate Professor of Statistics, Associate Director of Actuarial Science, Undergraduate Chair, Purdue University

What level of education do you teach? Where do you teach?

I have been the undergraduate chair in statistics at Purdue University since 2008. Purdue has one of the largest undergraduate programs in statistics in the United States. I am also associate director for actuarial science and the faculty adviser for Purdue's ASA Student Chapter. I am the PI for the NSF-funded Statistics Living Learning Community. I have an active research program that includes both graduate students and undergraduate students.

What or who inspired you to become a teacher?

My mom recently retired from a career as an elementary school teacher. Her work with students always inspired me. When I was in middle school, I spent a significant amount of time reading to my peers who couldn't read. I experienced the joy of helping others learn, so I decided to devote my life to learning and helping others learn.

I first learned about probability and statistics from Ron Selby, my high-school mathematics teacher. He had an inspiring style of conveying ideas about mathematics. My college professors Don Bonar and Joan Krone were particularly motivating mentors.

I also am inspired by my wife, Laura. Our children learn at home, rather than going to school. I love seeing how my wife and children interact with each other. I learn a great deal from Laura and our children, and I feel fortunate to be married to the smartest person I know.

Can you describe your day-to-day life as a teacher?

I spend a great deal of time with undergraduate students. Last year, I requested to move to the academic advising floor in our building because I talk with students and their advisers a lot. Students are constantly hanging out in my office. I try to maintain a comfortable research environment, where students can ask questions and push themselves to learn more than they might on their own.

I am a morning person, so I like to arrive early to campus, have my courses and seminars in the early morning, and go home to my family in time for dinner.

What has been your most satisfying teaching experience?

The Statistics Living Learning Community (STAT-LLC) has been the most satisfying experience for me. Twenty sophomore undergraduate students participate per year. They take their probability theory, statistical theory, and data analysis courses together as a cohort. They all live together on the same floor of the same residence hall, and I am their faculty fellow (a mentor role). They all have a full 12 months of research as sophomores.

We also have professional development seminars, visits with alumni, travel to conferences, etc. Quite a few of them came with me to JSM in Baltimore this summer. Our first cohort of students just graduated from Purdue this spring, and I miss them already.

The STAT-LLC has afforded me the opportunity to learn a great deal from our sophomores. In particular, I am always trying to better understand how to connect the disparate parts of their time spent on a college campus. I encourage my colleagues to do many things with students outside the classroom and office.

Every year, for instance, my wife, kids, and I go camping with the students, and we also feed them in our home. The students get a better understanding of the lifestyle of a faculty member as a result. I also eat with the students in their dining courts on a daily basis.

I think the more students know about the statistics profession, the more they are prepared to experience the joys and benefits of spending one's life working in this area.

What is the most challenging part of being a teacher?

I am not a fan of assessment. I prefer to focus on learning, rather than assessing.

How is teaching today different than it was when you first started?

Many learning environments include online components and group work. This will be my fourth year in which I conduct all my own courses in an "active learning" style.

The students in my probability theory course learn by working on problems in groups, rather than listening to me lecturing in class. I have created hundreds of videos, notes, and exercises with solutions to aid them in learning the material in between class sessions. The students in my data analysis course learn by working on data-driven projects, also in group settings.

I find that active learning promotes better long-term understanding. It also affords the opportunity for students to go deeper in their learning. By not spending a class session lecturing, I have more time to talk with students individually or in a group. It enables us to connect with the material in a more meaningful way.

What advice would you offer someone who is just starting their teaching career?

Be open minded with the learning environment you offer to students. Try to adopt your favorite methods from the peers you respect the most and find the way you and your students enjoy interacting the most.

Students appreciate faculty who wholeheartedly devote time to learning. Students also love to do research with faculty members. Research offers a great way to convey one's appreciation of the field to a student. Research and learning with students can make the life of a professor a sheer pleasure all the time. It doesn't feel like work when you truly love what you do.

What do you enjoy doing in your spare time?

Most of my time away from Purdue is consumed by time with my family. We particularly enjoy camping at Indiana state parks, as well as playing board games together. My hobbies including playing guitar (and occasionally harmonica) at our church. I also enjoy reading poetry.

Name one or two favorite blogs or books you have read and would recommend to others.

I recommend the blog Stats + Stories, *www.cas.miamioh.edu/statsandstories*.

My favorite book is *True Love*, by Robert Fulghum. It was published 20 years ago, when I was in college. I love how it describes the real-world aspects of love in its many forms.

Where do you get your favorite lesson plan ideas? What is your favorite teaching resource?

Ellen Gundlach and I wrote a book on probability together. She is a constant source of ideas for problems and activities students will love. We worked hard to create hundreds of exercises in our book that would be motivating for students. I also give her all the credit for introducing me to the concept of "active learning" and helping me transition all my own courses to this model. ■

Chris Olsen

Visiting Professor
Grinnell College

What level of education do you teach? Where do you teach?

After four years in middle school and 35 years in high school (interrupted by a stint as an "assessment specialist" in Cedar Rapids, Iowa), I am now teaching statistics at Grinnell College in Grinnell, Iowa.

What or who inspired you to become a teacher?

My inspiration was a terrific math teacher, Mr. Larsen, in high school. A wonderful person and a wonderful man. When I went to college, I thought I wanted to be an engineer and build bridges in South America. I knew nothing about engineering, bridges, or South America, but all my friends were going to college, so I figured I should also. A quick discovery of a singular inability to do engineering graphics (by hand in those pre-computer days) led to a quick decision—I wanted to be like Mr. Larson.

Can you describe your day-to-day life as a teacher?

My day-to-day life as a teacher begins on my commute, listening to National Public Radio and catching up with the world. I have pen and paper at hand in case there is a story about some new study that might be a good example of statistics. If there is one, I try to track it down when I get to the office; with any luck, it will reinforce my classroom assertion that statistics is not only relevant, it is constantly relevant!

My day in the office starts with checking email from students to see what problems have developed in the interim and getting ready for the day's classes (think caffeine here).

The best part of the day is my classes and the excitement interacting with young people. Between classes, I do the usual teacher things: prepare for the next class, re-write lessons and activities that I am—as they say in Casablanca—shocked(!) to discover need improvement. Then, at the end of the day, I head home with NPR (see above).

What has been your most satisfying teaching experience?

My most satisfying teaching experience occurs when the expressions on the faces of my students evolve from quizzical uncertainty to tentative understanding to (finally) that smiling countenance that says, "I have this nailed." As can be imagined, this transition is not universal and does not necessarily happen in one day.

To change the question a bit, my most heartwarming teaching experience occurs when I hear from former students who have discovered (sometimes with much surprise) they actually use statistics in their day-to-day professional lives.

What is the most challenging part of being a teacher?

For me, the most challenging aspect occurs when a student is struggling and I need to find a way to present the material differently, not just louder. I get stuck on those phrases that make sense to me, but don't translate well to those just beginning their journey through statistics. Different words? Different pictures? Different analogies? Different examples? I suppose variability is the heart and soul of statistics, but variability in students' understanding is a challenge indeed!

How is teaching today different than it was when you first started?

The salient difference is due to technology. The ready availability of calculator and computer has revolutionized what we can do, perhaps without a companion revolution in our understanding of what we should do. The graphic capability of these tools is breathtaking. It allows us to bring statistics to a much larger audience, and that larger audience to better utilize statistics. The power of statistical software has eliminated the drudgery of calculation and graphing, but cannot speak to the important issues of sampling on the front end and enlightened analysis on the back end.

I have always tried to find statistically interesting data sets from a variety of fields, but now I think it is increasingly important to discuss the non-computation non-graphical aspects of wrenching knowledge from data: What is the source of the data, and what meaning and insight can be gained from the results presented by the software?

What advice would you offer someone who is just starting their teaching career?

Read in journals outside the realm of statistics and digest both what and where statistics are used. Be prepared (and appreciate) that many of your students in elementary classes know more about their fields of study than you do. Learning is a lifelong activity, and your students will help keep you up to speed about that world beyond theoretical statistics.

What do you enjoy doing in your spare time?

Spare time. Hmm. I'll have to look into that concept. I mostly enjoy reading (plugging those vast holes in my knowledge) and computer programming (my "hobby").

Name one or two favorite blogs or books you have read and would recommend to others.

Most of my casual reading is cheap, trashy murder mysteries, but occasionally, by chance, I stumble into some more literary tomes. I can't decide on one or two, so I will offer three.

The Lost: The Search for Six of the Six Million, by Daniel Mendelsohn, is a fascinating weaving of Old Testament brother-brother relationships and his search for information about his family lost in the holocaust.

To everyone I see recently, I have been recommending *Killers of the Flower Moon: The Osage Murders and the Birth of the FBI,* by David Grann. That title says it all; I could not put it down.

In the fiction category, it would be tough to beat Louise Erdrich's *The Last Report on the Miracles at Little No-Horse.* Not to give anything away, long story short, it is a tale about a woman who assumes a priest's identity and functions in that role for many years at a Native American reservation.

These three are the best I have read since *Catch-22.*

Where do you get your favorite lesson plan ideas? What is your favorite teaching resource?

My favorite ideas basically come from (a) NPR, (b) *The New York Times* Tuesday Science section, and (c) trolling libraries and *JSTOR* to find real data for real students.

Truth be told, I enjoy reading about our fascinating world and I'm lucky to be able to claim I'm "planning" when on these little excursions into what we used to refer to as the stacks. ■

Professional Opportunity listings may not exceed 65 words, plus equal opportunity information. The deadline for their receipt is the 20th of the month two months prior to when the ad is to be published (e.g., May 20 for the July issue). Ads will be published in the next available issue following receipt.

Listings are shown alphabetically by state, followed by international listings. Vacancy listings may include the institutional name and address or be identified by number, as desired.

Professional Opportunities vacancies also will be published on the ASA's website (*www.amstat.org*). Vacancy listings will appear on the website for the entire calendar month. Ads may not be placed for publication in the magazine only; all ads will be published both electronically and in print.

Rates: $320 for nonprofit organizations (with proof of nonprofit status), $475 for all others. Member discounts are not given. For display and online advertising rates, go to *www.amstat.org/ads.*

Listings will be invoiced following publication. All payments should be made to the American Statistical Association. All material should be sent to *Amstat News*, 732 North Washington Street, Alexandria, VA 22314-1943; fax (703) 684-2036; email *advertise@amstat.org*.

Employers are expected to acknowledge all responses resulting from publication of their ads. Personnel advertising is accepted with the understanding that the advertiser does not discriminate among applicants on the basis of race, sex, religion, age, color, national origin, handicap, or sexual orientation.

Also, look for job ads on the ASA website at *www.amstat.org/jobweb.*

Williams

The Williams College Department of Mathematics and Statistics invites applications for a tenure-track position in Statistics, beginning fall 2018, at the rank of assistant professor (a more senior appointment is possible under special circumstances). The candidate should have a Ph.D. in Statistics or a closely related field by the time of appointment. We are seeking candidates who show evidence and/or promise of excellence in teaching students from diverse backgrounds and a strong research program that can engage undergraduate students. The candidate will become the sixth tenure-track statistician in the department, joining a vibrant and innovative group of statisticians with an established statistics major. For more information on the Department of Mathematics and Statistics, visit http://math.williams.edu/.

At Williams, we are committed to building a diverse and inclusive community where members from all backgrounds can live, learn, and thrive. In your application materials, we ask you to address how your teaching, scholarship, mentorship and/or community service might support our commitment to diversity and inclusion. Candidates may apply via http://apply.interfolio.com/43065 by uploading a cover letter addressed to Professor Klingenberg, a curriculum vitae, a teaching statement, a description of your research plans, and three letters of recommendation on teaching and research.

Expectations: The teaching load is two courses per 12-week semester and a winter term course every other January. The candidate will be expected to teach introductory statistics, core courses for the statistics major, and electives in their area of expertise. The successful candidate will establish an independent research program that results in scholarly publications. Williams College provides broad support for start-up funds, funding for student research assistants, faculty professional development funds, and a shared computer cluster for parallel computation.

Review of applications will begin on or after November 1st and will continue until the position is filled. All offers of employment are contingent upon completion of a background check. Further information is available at https://faculty.williams.edu/prospective-faculty/background-check-policy/.

Williams College is a coeducational liberal arts institution located in the Berkshire Hills of western Massachusetts with easy access to the culturally rich cities of Albany, Boston, and New York City. The College is committed to building and supporting a diverse population of approximately 2,000 students, and to fostering an inclusive faculty, staff and curriculum. Williams has built its reputation on outstanding teaching and scholarship and on the academic excellence of its students. Please visit the Williams College website, http://www.williams.edu/.

Massachusetts

■ The University of Massachusetts Amherst (*www.umass.edu/sphhs*) seeks 2 tenure-track faculty at the rank of assistant professor in biostatistics starting September 2018. Requirements: terminal degree (PhD, DrPH), experience or potential as principal investigator of independent and collaborative research, and interest and ability in teaching. Review of applications begins September 15, 2017. Submit CV, description of research and teaching interests, and three letters of reference online: *http://umass.interviewexchange.com/joboffderdetails.jsp?JOBID=86465.* University of Massachusetts Amherst is an EOE.

■ Applications are invited for a tenure-track position in statistics at Amherst College to begin July 2018: see the full ad and requirements at *MathJobs.org.* We seek faculty with broad intellectual interests, a strong commitment to research, and a passion about teaching statistics and data science to undergraduates. Applications received by October 8, 2017, will be guaranteed consideration. Questions can be addressed to *mathstats@amherst.edu*. Amherst College is an equal opportunity employer and encourages women, persons of color, and persons with disabilities to apply. The college is committed to enriching its educational experience and its culture through the diversity of its faculty, administration, and staff.

North Carolina

■ Rho, Inc. has an excellent opportunity for a highly motivated and talented individual to provide leadership and growth on federal research projects and programs in the role of principal investigator (PI) or co-principal investigator (co-PI). Much of the federal work at Rho is on large, multi-center clinical trials or clinical trial programs, where Rho is the clinical, statistical and data coordinating center. *https://careers-rhoworld.icims.com/jobs/1342/principal-statistical-scientist/job.* EOE. Veterans/Disabled.

Faculty Positions Available

The Department of Statistics at Texas A&M University anticipates multiple Assistant Professor positions (tenure/tenure-track) to begin September 2018. Completion of all requirements for a PhD/DSc degree in Statistics (or a closely related field) prior to beginning employment is required. The department encourages persons from all areas of research to apply, but is particularly interested in areas at the interface of statistics and computer science (i.e., big data, computational statistics and data mining) and in spatial statistics. Successful candidates will have a strong commitment to research and teaching. Excellent computing facilities are available and highly competitive startup funding is anticipated.

The department has a tradition of outstanding theoretical and interdisciplinary research. Current faculty members actively collaborate with colleagues in the Colleges of Science, Agriculture and Life Sciences, Engineering, Geosciences, Medicine, Public Health, Veterinary Medicine, and with the Faculties of Genetics, Nutrition and Toxicology. For more information on the department and the research interests of its faculty, please visit www.stat.tamu.edu. **To apply, please visit** AcademicJobsOnline.org/ajo/jobs/9366. Applications will continue to be accepted until the positions are filled.

Texas A&M University is an equal opportunity/affirmative action employer. The university is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment and strongly encourages applications from women, minorities, individuals with disabilities and veterans. Texas A&M University has a partner placement program and is responsive to the particular needs of dual career couples. The Department of Statistics is interested in candidates who can contribute to the diversity of the academic community through their research, teaching and/or service.

Virginia

■ Statistician open rank faculty search, tenure track faculty position in Virginia Tech Department of Statistics. PhD in statistics or closely related field required. Open rank, though associate or full preferred. Successful applicant will have expertise in computationally intensive statistical methods and high performance computing. Submit application online at *http://listings.jobs.vt.edu* (#TR0170087). Applications review to begin on November 1, 2017, and will continue until position filled. Virginia Tech is an EO/AA university.

■ Biostatistician open rank faculty search. Tenure track biostatistics faculty position in Virginia Tech Department of Statistics. PhD in statistics, biostatistics or closely related field required. Open rank, though associate or full preferred. Successful applicant will develop and lead biostatistics / health analytics group. Submit application online at *http://listings.jobs.vt.edu*

VirginiaTech
Invent the Future

TEACHING FACULTY POSITIONS

Virginia Tech (**www.vt.edu**) has two faculty openings in the Department of Statistics (**www.stat.vt.edu**) to start Fall 2018 at our Blacksburg, VA campus. Appointment at the rank of Collegiate Assistant Professor is preferred, but the Associate level will be considered for exceptional candidates. These are full-time, multi-year appointments (three years for Assistant Professor and five years for Associate Professor) with multi-year renewal upon successful review.

We seek candidates who are passionate about teaching statistics to undergraduate and graduate students. Responsibilities include teaching three courses per semester, where successful candidates will:

- Make significant contributions to our instruction in statistics; coordinate introductory and service courses, work closely with our undergraduate students, engage in a variety of significantly growing statistics curricula across the university, and lead efforts in curriculum enhancements and innovative pedagogy;
- Continue to develop professional capabilities and participate in scholarly activities, including travel to and participate in professional conferences and societies; and participate in department, college, and university service and governance, as well as professional service.

These positions are part of a major emphasis on statistics, including computational modeling, data science and analytics, and empirical decision making at Virginia Tech. Successful applicants will have the opportunity to be key players in the creation of the university's "Data Analytics and Decision Sciences" destination area (**http://provost.vt.edu/destination-areas/da-data.html**) and to teach in the Computational Modeling and Data Analytics and program (**http://www.ais.science.vt.edu/programs/cmda.html**) within the College of Science's Academy of Integrated Science as well as the School of Neuroscience (**www.neuroscience.vt.edu/index.html**).

Applicants must have a Ph.D. in Statistics, Biostatistics, or a related field with a strong statistical emphasis, and have broad intellectual interests in statistics and statistics education along with a strong promise for being a leader in the instructional mission of the department. Desirable characteristics include a record of pedagogical achievement and vision, creativity, and leadership skills relevant to instruction.

Applications must be submitted online at **www.jobs.vt.edu** (postings **#TR0160135 and #TR0170086**). The application should include a cover letter, curriculum vitae, and a teaching statement that specifically addresses your teaching experience and passion for communicating statistics and statistical methods. Please include names, addresses, telephone numbers, and e-mail addresses for three or more references in the cover letter. As part of the hiring process, the successful applicant must pass a criminal background check.

Questions regarding the position can be directed to **Dr. Pang Du, Chair, Faculty Search Committee, Hutcheson Hall, 250 Drillfield Dr., Virginia Tech, Blacksburg, VA 24061**, Tel. **(540) 231-5198**, E-mail: **vtstat_search2017@vt.edu**. Applications will be accepted until the position is filled, but all applications received by November 1, 2017, will be guaranteed full consideration.

Virginia Tech is an Equal Opportunity/Affirmative Action Institution.

(#TR0160168). Applications review to begin on November 1, 2017, and will continue until position is filled. Virginia Tech is an EO/AA university.

■ Teaching faculty positions in statistics. Multiple faculty teaching positions in Virginia Tech Department of Statistics to start fall 2018. PhD in statistics, biostatistics or closely related field required. Appointment at rank of collegiate assistant professor preferred, but associate level considered for exceptional candidates. Submit application online: *http://listings.jobs.vt.edu* (#TR0160135 and #TR0170086). Applications review to begin on November 1, 2017, and will continue until position is filled. Virginia Tech is an EO/AA university.

■ The Department of Mathematics at the College of William and Mary seeks applications for a tenure-track position at the assistant or associate professor level in statistics or related areas. Applicants must

TENURE-SYSTEM FACULTY POSITION
IN BIOSTATISTICS

The Department of Epidemiology and Biostatistics at Michigan State University (MSU) invites applications for a tenure system faculty position, academic year basis, for its expanding research, teaching and consulting missions. The position is a part of MSU's Global Impact Initiative, designed to address the grand challenges through the creation of over 100 new faculty positions in some of the most promising and exciting fields of research.

The position will be filled at the level of Professor or Associate Professor depending on the qualifications and record of the successful candidate. Applicants must have a PhD in Statistics/Biostatistics, or related quantitative discipline and have previous research and teaching experience. The successful candidate is expected to make significant contributions to research; develop and maintain a vigorous independent and collaborative research program; participate in teaching and mentor junior faculty and graduate students; and provide statistical consultation to graduate students in the department and in the College of Human Medicine. It is envisioned that the candidate will assume a leadership role in the department.

We have interest in candidates with research expertise in several areas including, but not limited to, design and analysis of randomized clinical trials, comparative effectiveness, and healthcare studies. Candidates should have training and experience in applications of novel statistical methodologies to the health sciences. The individual must have excellent verbal and written communication skills, and the motivation to act as a team member in collaborative research ventures.

Application should be submitted on-line at **http://careers.msu.edu** for posting **448834**. Include a letter of interest, curriculum vitae, statement of research interests, teaching philosophy and contact information for three references (applicant will be notified prior to contacting references). Applications will be accepted until the position is filled. Review of candidates will begin immediately. Questions regarding the position should be addressed to: Search Committee Coordinator, Mary Ann Vigil, **vigil@msu.edu**

MICHIGAN STATE UNIVERSITY

College of Human Medicine
Department of Epidemiology and Biostatistics

MSU is committed to achieving excellence through cultural diversity. The University actively encourages applications and/or nominations of women, persons of color, veterans and persons with disabilities.

MSU is an Affirmative Action, Equal Opportunity Employer.

OPEN-RANK DATA ETHICS FACULTY POSITION

The College of Information Sciences and Technology (IST) (http://ist.psu.edu) and the Department of Statistics in the Eberly College of Science (http://stat.psu.edu) at The Pennsylvania State University invite applications for an open-rank tenure-track faculty position in data ethics, to begin August 2018. The tenure home of this position, either the College of IST or the Department of Statistics within the College of Science, will be determined based on the strengths and research interests of the successful candidate, as well as the preference of the candidate. The successful candidate will have a strong record in data ethics in one or more data-related research areas with an intrinsic data ethics component, along with a demonstrated interest in applying this work to serve the public interest. Data-related research areas of interest include, but are not limited to, statistics or informatics of privacy; reproducibility of research; standards for openly sharing data and code; ethics implications of machine learning models, personalized medicine, genomics, environmental research, and socio-technical systems; and technological innovations for ensuring fairness of machine learning models.

This position is part of a transformative series of thirteen tenure-track appointments in ethics designed to ensure that Penn State becomes a leader in ethics-informed interdisciplinary research and the integration of ethical literacy throughout the Penn State curriculum. The successful candidate will be affiliated with the Rock Ethics Institute at Penn State (http://rockethics.psu.edu/). We are seeking candidates who will build on the Institute's tradition of excellence in collaborative, interdisciplinary ethics research and ethically informed decision support for significant societal issues, as well as their success in integrating ethics into the curriculum. More specifically, we are looking for individuals who will be effective in working on and leading interdisciplinary teams that embed ethical analysis into research projects related to data sciences, and who have experience and interest in integrating ethics into undergraduate and graduate curriculum. Faculty who are hired will receive a one-course release for the first five years for enhancing existing ethics research and curricular initiatives as well as building new initiatives and programs aligned with the Institute's mission. We envision the successful candidate to take a leadership role in data ethics research in collaboration with related research activities at Penn State such as the NIH-funded Biomedical Big Data to Knowledge (B2D2K) Training Program and the NIH-funded Penn State Clinical and Translational Science Institute (CTSI). The College of IST and Department of Statistics both already have a significant number of faculty members active in data-related research, which will provide plenty of opportunities for collaborations regarding data ethics. We also envision that the successful candidate will take an active role in establishing a strong ethical component in a newly formed undergraduate major in data sciences. This major, co-administered by three colleges at Penn State—IST, Science, and Engineering—provides a unique opportunity to enhance data ethics education that would be accessible to students within the new major as well as students from related majors across the university.

The Pennsylvania State University is the land grant institution of Pennsylvania. In the 2013 institutional rankings of total research expenditures in science and engineering released by the National Science Foundation, the Penn State placed 17th overall nationally, and was placed 2nd (tied with the Massachusetts Institute of Technology) for the total number of disciplines that are ranked among the top ten nationally.

To apply, please complete the online application at https://psu.jobs/job/72577. IN ADDITION, interested applicants should submit the following material to https://academicjobsonline.org/ajo/jobs/9332: (1) a cover letter that clearly explains how the applicant's work relates to the Rock Ethics Institute's mission and how a position within the Institute is likely to augment their own work, (2) a curriculum vitae, (3) a three- to five-page research statement, (4) a one-page teaching statement, and (5) contact information of three to five professional references. Review of applications will begin immediately and continue until the position is filled, with priority given to applications received by October 15, 2017. Inquiries about the position may be directed to facultyrecruiting@ist.psu.edu and/or depthead@stat.psu.edu.

CAMPUS SECURITY CRIME STATISTICS: For more about safety at Penn State, and to review the Annual Security Report which contains information about crime statistics and other safety and security matters, please go to http://www.police.psu.edu/clery/, which will also provide you with detail on how to request a hard copy of the Annual Security Report.

Penn State is an equal opportunity, affirmative action employer, and is committed to providing employment opportunities to all qualified applicants without regard to race, color, religion, age, sex, sexual orientation, gender identity, national origin, disability or protected veteran status.

Assistant Professor, Biostatistics

The University of Nevada, Reno, School of Community Health Sciences is seeking a candidate for one nine-month, tenured track position in Biostatistics at the rank of Assistant Professor. The School offers an MPH in Epidemiology, Biostatistics, Social-Behavioral Health, and Health Administration and Policy and BS in Community Health Sciences, with a plan to develop MS in Biostatistics and provide substantial support to the PhD in Public Health in Epidemiology and Social Behavioral Health. Research and teaching interest should be in the area of biostatistics. The successful applicant is expected to engage in both independent and collaborative research projects, teach successfully in the graduate and undergraduate programs, provide statistical consultative support to other health researchers in the university system and engage in the development of a new School of Public Health.

The University of Nevada, Reno is the State of Nevada's land grant institution of higher education and is one of eight institutions of higher education governed by the Nevada System of Higher Education. With a growing and increasingly diverse student enrollment of approximately 21,000 including over 2,800 graduate students, the University provides a comprehensive selection of degree programs at the undergraduate, graduate and doctoral levels. The University is currently classified (Carnegie) as "Research University/High" which places it among the top 200 colleges and universities in the United States. Located in the picturesque Truckee Meadows at the base of the Sierra Nevada, the University of Nevada, is located 45 minutes from Lake Tahoe and within four hours from San Francisco and the Napa-Sonoma wine country.

The University of Nevada, Reno recognizes that diversity promotes excellence in education and research. We are an inclusive and engaged community and recognize the added value that students, faculty, and staff from different backgrounds bring to the educational experience.

To apply, please visit: https://www.unrsearch.com/postings/24784

Women, under-represented groups, individuals with disabilities, and veterans are encouraged to apply.

hold a PhD in statistics or a related field by August 2018. More information about the position and Applied Mathematics at William and Mary may be found at *http://jobs.wm.edu/postings/28880*. EOE.

Washington

■ Cancer Research And Biostatistics (CRAB) is a non-profit organization whose purpose is to help conquer cancer. Our Statistics department is looking for a dedicated senior biostatistician. The successful candidate will collaborate with fellow biostatistics staff and clinical investigators to design efficient clinical trials and determine the optimal methods for analysis of the data. View the duties and qualifications at *www.crab.org*. Remote work not available. EOE. ■

Department of Applied and Computational Mathematics and Statistics
Assistant, Associate or Full Professor of Statistics

The Department of Applied and Computational Mathematics and Statistics (ACMS) at the University of Notre Dame has two statistics positions at ranks from tenure-track assistant professor to tenured professor level to fill this year. Preference will be given to applicants whose research includes multi-disciplinary collaborations.

ACMS includes research groups in applied mathematics, statistics and computational science. ACMS offers a Bachelor of Science, a doctoral degree, a research master's degree, and a professional master's degree. ACMS is a department in the College of Science.

The successful statistics applicants must have a doctorate in statistics, biostatistics, or a closely related field, and a record of success in both research and teaching. The teaching load in ACMS is three courses per year, and the positions begin in August 2018. We will begin reviewing completed applications October 1, and continue accepting applications through December 1.

Applications, including a cover letter, curriculum vitae, research and teaching statements, and if the application is for a tenure-level position, teaching evaluations from the past three years should be filed through Interfolio: Assistant Professor: https://apply.interfolio.com/42769 and Associate/Full Professor: https://apply.interfolio.com/42770. Applicants should also arrange for at least three letters of recommendation to be submitted through the Interfolio system. These letters should address the applicant's research accomplishments and supply evidence that the applicant has the ability to communicate articulately and teach effectively. Applicants are invited to contact the Department Chair, Andrew Sommese, at sommese@nd.edu, at any time.

Notre Dame is an equal opportunity employer, and we particularly welcome applications from women and minority candidates.

acms.nd.edu

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This position requires a master's degree or Ph.D. in statistics with coursework in survey sampling or a master's or Ph.D. in survey sampling. Candidates with a master's must have at least 8 years of experience in sample survey design, selection, or weighting and a Ph.D. with 6 years' experience. Although not required to do programming, candidates would benefit from knowing SAS and other statistical software packages. Qualified candidates must have excellent written and oral communication skills, strong organizational skills, and the ability to handle multiple tasks simultaneously.

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Virginia Tech
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DEPARTMENT OF STATISTICS
2 Open-Rank Tenure-Track Positions

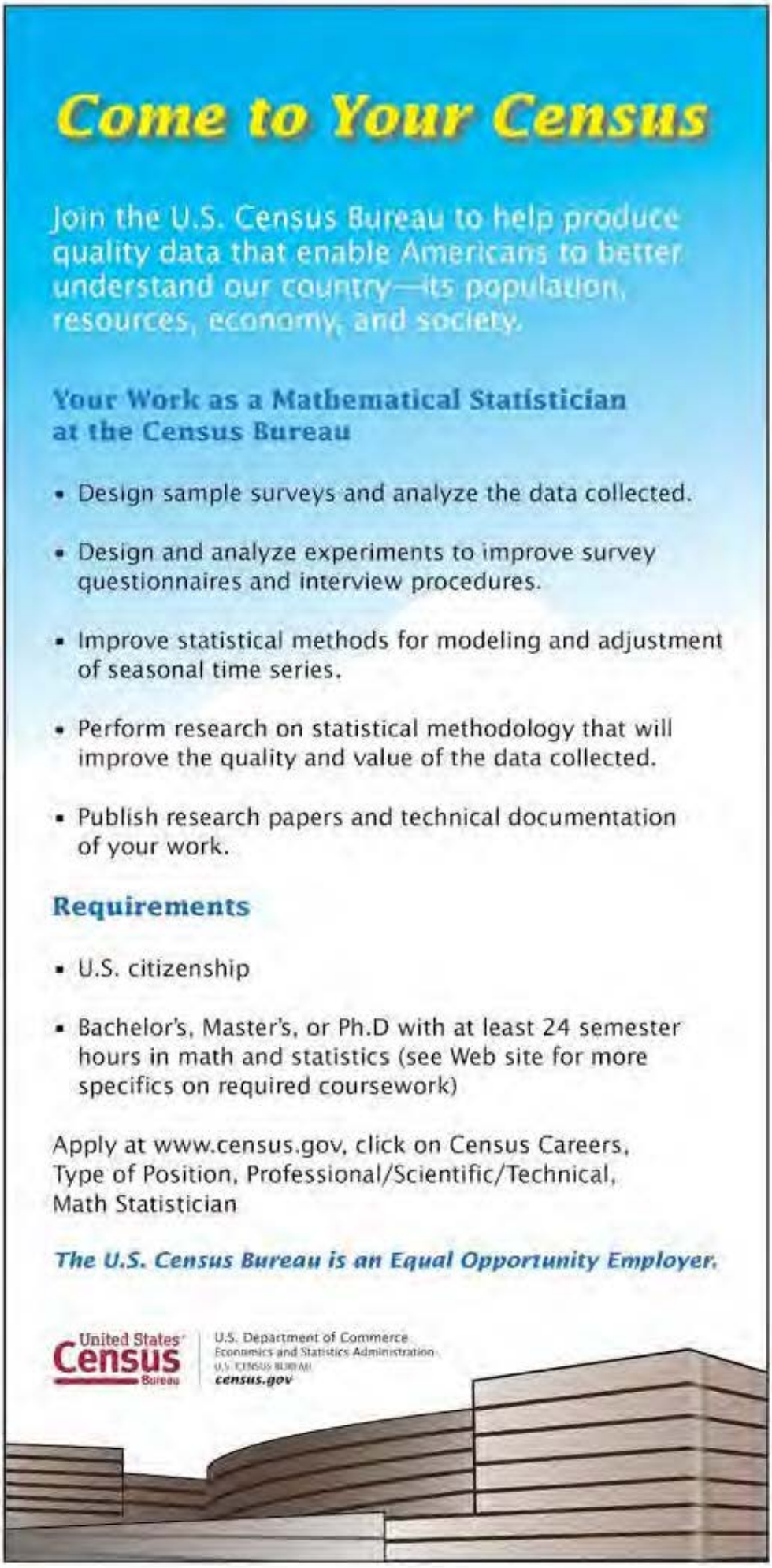
The Virginia Tech Department of Statistics (**www.stat.vt.edu**) has two tenure/tenure-track openings. We seek individuals with established track records in statistics, well-funded, internationally distinguished research programs, and who excel in teaching. Applicants must have an earned Doctorate in statistics or closely related field at the time of appointment.

- **STATISTICIAN:** The successful applicant will have a strong background in computationally intensive statistical methods and high performance computing with a research focus in data analytics, machine learning, data mining, stochastic modeling/inference, interactive data visualization, or a similar area. This position is part of a major emphasis on statistics, including data science and analytics at Virginia Tech (**http://provost.vt.edu/destination-areas/da-data.html**). This position will support of the Computational Modeling and Data Analytics (CMDA) program (**http://www.ais.science.vt.edu/programs/cmda.html**), a multi-department effort including the Departments of Statistics, Mathematics, and Computer Science. Questions regarding this position can be directed to Dr. Robert Gramacy, Statistician Search Committee Chair, **rbg@vt.edu**.
- **BIOSTATISTICIAN:** The successful applicant will have a specialization in some area of health-related statistics, such as biostatistics, bioinformatics, or genomics, and will be a leader in developing and expanding our health sciences research program. This position is part of a major emphasis on biostatistics and health analytics within the Data Analytics and Decision Sciences destination area at Virginia Tech (**http://provost.vt.edu/destination-areas/da-data.html**). Located in the Health Sciences and Technology Innovation District in Roanoke, (**http://vtnews.vt.edu/articles/2016/03/bov-hstdistrict.html**), the successful applicant will play a significant role in the development and leadership of a biostatistics/health analytics group that will collaborate with scientists across the university, including the Virginia Tech Carilion Research Institute, the Virginia Tech School of Medicine, and the Biocomplexity Institute of Virginia Tech. Questions regarding this position can be directed to Dr. Ron Fricker, Biostatistician Search Committee Chair, **rf@vt.edu**.

Applications are due by November 1, 2017 and must be submitted online at **listings.jobs.vt.edu**
(**Statistician posting #TR0170087; Biostatistician posting #TR0160168**).
Interviews may start as early as December 1, 2017.

Virginia Tech is an EO/AA university, and offers a wide range of networking and development opportunities to women and minorities in science and engineering, and additionally provides a competitive dual hiring program for couples.

Virginia Tech is an Equal Opportunity/Affirmative Action Institution.



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Next month's question: What book about statistics do you recommend for nonstatisticians?

Eric J. Daza Professor Michael Hudgens (UNC Department of Biostatistics) taught me how to hone my constant whirlwind of curious tendencies into a focused, cohesive, well-crafted, and compelling line of argument. He also had the confidence in what he did know to be able to say "I don't know" when warranted—a trait of maturity I admire and strive to emulate.

Ryan Machtmes Several call outs to the great faculty in the Department of Experimental Statistics at the Louisiana State University. Particularly Dr. James Geaghan, one of the kindest people I've ever met, as well as Drs. Charles Monlezun and Brian Marx for similar reasons. And, as much as his course on inference was an exercise in "sweating blood" (as he was prone to advocate students do), Dr. Luis Escobar certainly developed in me my dedication to "be among the greats who are always working."

Brenda Layne Lynne Saba from Fielding Graduate University who said, "hey, you're good at this, you could make a living as a statistician" and then proceeded to teach me the foundations of what has become my awesome career!

Violeta Carrión Leland Wilkinson UIC. He brought a laptop (not common in those days) to class and showed a 3D picture of the data and rotated it. Everything I knew of statistics fell in place for me.

Jan Har Uwe Ligges of the TU Dortmund. He successfully shared his passion with R and I nowadays have the honour of working as a tutor for him.

Don Hedeker R. Darrell Bock at UChicago. He always pushed students to go higher.

Champ Tharakorn Assoc. Prof. Thongkam Maiklad at KMUTNB. She is such an inspiration to me as a researcher in statistic model.

Ashwin Satyal Dr. Chen Pai Han from UT Arlington. Passion and commitment for teaching

Cliff Claven Dr. Frank Ponti, who taught at Drexal. I worked for him at the US Defense IG office. For a mathematician/statistician, it was like working for Santa Claus.

Satish Agrawal Dr. Umesh Kale was my favourite Statistics teacher during graduation as he was knowing breadth and depth of the subject and his approach was not just exam oriented.

Cristian Camilo Rodriguez Armando Baena Zeta because he makes me like statistics and its importance in every life moments. Although its importance in scientific research

Pankaj K Agarwal Shiv Shankar Tripathi Sir from my high school. Kindness and mastery over mathematics competed for becoming his best trait.

Dav Smadja Christian Robert ! He for sure knows how to communicate his passion and enthusiasm for statistics without taking all the subtleties of his proofs apart

Nathan Kidwell Had many… But Alexander Korostelev at Wayne State University in Detroit got me hooked on probability and statistics!

Mukanzi Miheso Prof. Thomas Achia. Passion Pragmatism Faith

Anthony Skillman Dr. Douglas Montgomery. Arizona State University. Excellent author and wonderful teacher. Tough but fair.

James Love Randy Carter at Univ of Florida Biostatistics Unit in 1983. Randy showed me how to work as a statistician.

Jennifer Daddysman @j_daddysman Too many to count! And none are on Twitter. But my favorites always had high standards yet showed they cared about their students.

Avraham Adler @AvrahamAdler Robert Batten from @GeorgiaStateU #actuarial department. Scholar, Gentleman, Patient, and clearest explanation of concepts I've ever heard.

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