Interview with James J. Cochran

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Beginnings

AR: Thanks very much, Jim, for agreeing to this interview for the Journal of Statistics Education. Let’s start when you were 18 years old. Where were you, and what were your career aspirations at that point?

JC: Thank you, Allan, for this opportunity! When I was 18, I was a commuter student at Wright State University. I knew I wanted to do something with mathematics, but after 1 year of college, I had not found it. I was working at the Trotwood branch library to put myself through school, so I had access to a great collection of books, and this led me to take interesting courses in several disciplines that I may not have otherwise considered—anthropology, geology, psychology, philosophy, political science, religion, and computer science in addition to mathematics. But I had not found anything that really grabbed and held my interest. I might have majored in architecture, but Wright State didn’t have an architecture program. I considered majoring in geology, but I had not yet firmly committed in any way to doing so. I also had never given any thought to attending graduate school. I was the first person in any branch of my family tree to graduate from high school, so going to college to earn an undergraduate degree was as much as I had imagined for myself. I was trying to figure out what I wanted to do and systematically eliminating several possibilities from consideration, which is probably the way most college students spend their first few years of study.

AR: That’s great that you were a family pioneer. How and when did you find your academic passion?

JC: It happened gradually. During my sophomore year, I took a few economics courses from a very engaging professor. He made it easy to see how mathematics could play an important role in an economics education and career, so I decided to major in economics. I also enjoyed the courses I ultimately took in advanced mathematics—abstract algebra, real analysis, etc.—but I could not shake the desire to work on real problems and try to make a difference in other people’s lives, and economics seemed to offer an opportunity to do so. However, as I moved deeper into my economics coursework, I gradually realized that I was far more attracted to the analytic methods than to the discipline to which I was applying the methods. I also began to develop a deep appreciation for how applied mathematics could allow me to work across a wide variety of disciplines and problems while also satisfying my desire to work on real problems and potentially have a positive impact on the lives of others.

During my senior year, I was encouraged by several of the economics faculty at Wright State to go to graduate school; this was a tremendous boost to my confidence. By the time I had earned my undergraduate degree in economics, I knew I wanted to further my studies and reorient my focus to applied mathematics. I then decided to pursue graduate degrees in economics and quantitative methods simultaneously. As I was completing these degrees, I was offered an opportunity to teach calculus and introductory statistics, operations research, and computer programming for Wright State’s business school. I subsequently spent 3 years as a full-time member of the Wright State faculty. During this period, I came to realize how much I enjoyed applied mathematics—specifically statistics and operations research—and teaching. I was very fortunate to have these opportunities and the support and encouragement of many faculty members at Wright State; this enabled me to figure out what I wanted to do with my life when I was in my early twenties, and that was and is a rare and wonderful gift.
AR: I have to confess that I’m never sure what the term “quantitative methods” means. I assume that in your case this included a lot of statistics and operations research; am I right? And where in your studies did you first encounter statistics—as an undergrad or in graduate school? Was statistics part of your economics courses, or part of quantitative methods courses, or did you take courses specifically in statistics (or none of the above)?

JC: For me, quantitative methods referred to a combination of statistics and operations research—what we would now call analytics. But my first encounter with statistics as a student was in high school—during my junior year, I took a semester long course in basic probability and statistics. The teacher who taught calculus at my high school also taught the probability and statistics course, so it naturally was heavy on probability and light on statistics!

My undergraduate studies included several statistics courses. Economics majors at Wright State were required to take two courses in statistics that took us from descriptive statistics through inference, design of experiments, and multiple regression. We could take elective courses in econometrics and mathematical economics as electives, and I took both. I also took a class in advanced statistics for political science and two courses in operations research. A few other of my undergraduate economics courses were statistically oriented, depending on the subject and the interests of the instructor.

Almost all of the courses in my MS program in economics had a substantial statistical and/or mathematical orientation, and I took courses in design of experiments, sampling, multivariate analysis, optimization, and simulation as part of my quantitative methods degree program. It was at this point that I began to think a great deal about problems at the interfaces between statistics and operations research and the associated research opportunities.

My coursework gave me a strong foundation in statistics and operations research while allowing me to develop an appreciation for the wide range of problems to which these two disciplines could be applied. My coursework was also great preparation for my first two full time positions—3 years as an instructor of quantitative methods at Wright State and then 3 years as director of the analytic services division of Burgoyne Marketing Research.

AR: So you left the academic life for a while? What prompted that move, how did you find the experience, and what led you back to academia?

JC: I enjoyed working in academia very much, but I recognized that I was not experiencing a full academic life. I taught four sections—usually three different courses—each academic term. Little else was expected of me, and I had little time for anything else. I taught courses in descriptive statistics, probability, inference, applied linear models, deterministic operations research, stochastic operations research, calculus, and computer programming in COBOL and Pascal. In each of these courses I enjoyed interacting with students and helping them appreciate and understand statistics, operations research, mathematics, and computer programming.

But while I was on the Wright State faculty I did almost no academic research and I did not fully understand what was involved in establishing and maintaining an academic research agenda. I also had little experience outside of academia other than a few summer internships and the part-time job at a small branch library I held in high school and throughout my undergraduate studies. I thought I might enjoy life as an academic, but I was not sure because I had little experience in academic research or working outside of academia, so I decided to see what it was like to work in industry and determine if that was what I wanted to do with my life.

I went to work at Burgoyne, which was at that time one of the 20 largest marketing research companies in the United States, as Director of the company’s Analytic Services division. I was responsible for advising account executives on study designs and statistical analyses for studies they were proposing to clients, overseeing the analyses of the data that were collected for studies, developing and managing a staff of analysts, reviewing and approving reports on the results of my staff’s analyses, and improving the understanding of all aspects of statistics throughout the company.

When I arrived at Burgoyne, the company’s account executives tended to sell marketing research studies that utilized basic inference and relatively simple linear models (multiple regression, ANCOVA, etc.). As my staff and I worked with the account executives on their proposals, we would often suggest more appropriate study designs and analyses than the account executives had originally considered. Because the designs and analyses we suggested were often unfamiliar to the account executives, we created and gave several short courses to broaden the account executives’ understanding of statistics and encourage them to expand the range of study designs and statistical methodologies they would propose to their clients. We also opened these short courses to employees throughout the company to provide opportunities for their professional development. When our clients learned of these short courses, several asked us to reprise the short courses for their employees at their headquarters.

I initially enjoyed working on real problems, expanding the range of study designs and statistical methods the company employed, and finding more effective ways to communicate statistical concepts to colleagues and clients, but I eventually became bored with the work. I also missed teaching in an academic setting, and I remained interested in working on academic research, so I decided to return to school to work on my Ph.D.

AR: Where did you get your Ph.D., and what did your dissertation investigate?

JC: I received my Ph.D. in statistics with support areas in operations research and mathematics from the University of Cincinnati in 1997. My coursework, comprehensive exams, and dissertation all focused on both statistics and operations research. I completed all the degree requirements in both disciplines, and I even had two dissertation cochairs, one from statistics and one from operations research.

My dissertation focused on the statistical ramifications of solving constrained optimization problems for which the values
of one or more parameters is estimated with sample data. I proved that under very mild conditions, the optimal value of the objective function that results from such problems is liberally biased. That is, if we are maximizing the objective function, the maximand that results when the value of a parameter is estimated with sample data tends to overestimate the maximand that results when the value of a parameter is known. Similarly, if we are minimizing the objective function, the minimand that results when the value of a parameter is estimated with sample data tends to underestimate the minimand that results when the value of a parameter is known. I developed bootstrap approaches to estimate this bias and produce a theoretically bias-free estimate, and I developed an algorithm for dealing with the massive computational requirements of repeatedly solving a complex optimization problem with different estimated values of parameters. I also developed Bayesian and predictive approaches to several classes of combinatorial optimization problems. I have continued to focus on problems at the interface of statistics and operations research throughout my academic career.

AR: Did you consider going back to industry when you finished your Ph.D., or were you committed to academia at that point? Where did you end up next?

JC: I never considered returning to industry—I had a few very lucrative offers to return to industry while I was working on my Ph.D., but at that point I was certain I wanted to return to academia. And as the amount of time I devoted to research increased, my affinity for research rapidly grew. I have always enjoyed teaching, but by the time I had finished my dissertation I realized I enjoyed research even more than I enjoyed teaching. So I knew that I would be very happy with at least 90% of what I would be expected to do as an academician. What job—other than playing in the Cincinnati Reds’ infield or the Cincinnati Bengals’ defensive backfield—could possibly provide me with that level of satisfaction?

I took visiting positions at Miami University and the University of Cincinnati and focused on research while I looked for a tenure track position at a school with a doctoral program. I eventually landed at Louisiana Tech University in north central Louisiana, and I worked there for 14 years. During that period, I spent time as a visiting scholar with Stanford University’s statistics department, the Universidad de Talca’s department of industrial engineering, the University of South Africa’s department of decision sciences, and Pôle Universitaire Léonard de Vinci’s college of engineering. I also held honorary appointments with the University of Limpopo and the University of KwaZulu Natal.

Faculty Career

AR: What department were you with at Louisiana Tech? What courses did you typically teach? How would you describe your teaching style/approach at that point in your career?

JC: I was sort of an internal academic nomad during my first several years at Louisiana Tech. I started in the Department of Information Systems and Analysis. Two years later, I was reassigned to the Department of Economics and Finance, which was then renamed the Department of Economics, Finance, and Analysis. Two years later, I was reassigned again, this time to the Department of Marketing—which, no surprise, was then designated the Department of Marketing and Analysis. That was my home department for my last 10 years at Louisiana Tech.

When I arrived at Louisiana Tech, every student in the Business School’s doctoral program took three statistics courses—a course in regression, a course in multivariate statistics, and a course in nonparametric statistics and design of experiments—that could be taken in any order. The only prerequisites for these courses were an undergraduate introductory statistics course and an undergraduate business calculus course. I redesigned these three courses to create a three-course sequence that covered regression, design and analysis of experiments, and multivariate statistics from an applied linear models perspective, and I developed and administered a linear algebra bootcamp for the students to take at the onset of this sequence. I also taught an undergraduate introductory business statistics course, an introductory operations research course for the MBA program, regression for categorical data, survival analysis, and optimization in finance. I prepared to teach courses in sports analytics and cryptography, but these courses ultimately were never offered.

I had already developed a strong case method orientation, and I used cases heavily in the courses I taught for undergraduates and MBA students. I also developed and used a wide variety of active learning exercises for the undergraduate statistics course, and I used live data and projects extensively in the doctoral courses. Since I was teaching in a business college, the primary objective was to help the students understand how to use statistics and the circumstances under which they could/should use statistics.

While at Louisiana tech, I wrote several original cases for statistics and operations research. I developed a classroom version of Who Wants to be a Millionaire, several other classroom games, and boomerang quizzes. I turned some simple card tricks into active learning exercises. I also created a fun and effective exercise I called scripting. Scripting requires students to rewrite the dialog, thoughts, and narration for a series of images from a popular cartoon so that one character would explain some statistical concept to the other character in the cartoon. I continued to progressively move further away from a straight lecture format and toward a student experience orientation with Socratic overtones.

AR: I know that you have since moved to the University of Alabama. What prompted your move, and what courses have you taught at Alabama?

JC: Louisiana Tech does not offer a doctoral program in either statistics or operations research, and the University of Alabama offered me a chaired position and the opportunity to work in a department with separate Ph.D. programs in statistics and operations research. The department that offers these programs is home to faculty in statistics, operations management, and management information systems; these three disciplines are important components of my research interests. Alabama
also offered me the opportunity to lead its effort to develop a new Master’s degree program in Business Analytics. Finally, after 14 years in Louisiana, I was restless and felt the need for a change—for new challenges in a new environment. I liked The University of Alabama and its campus very much, and my wife and I were very impressed with Tuscaloosa when we visited. It is a college town, without a doubt, but it is rather large for a college town—the population is approximately 100,000, and that probably doubles when the football team is playing a home game—so the city offers reasonable amenities.

During my first 2 years at Alabama, I taught undergraduate introductory business statistics and graduate-level courses in linear models, multivariate analysis, data management, data mining, and machine learning. I became chair of my department on an interim basis in December of 2016, and from there I moved into the role of the Culverhouse College’s Associate Dean for Research in May of 2017. I have not taught since I became a full time administrator. I miss the classroom and working with students very much, but I enjoy the role I am now in because it is very strategically oriented—my job is to create ways to improve the college’s research profile and productivity. I have been an active researcher throughout my academic career, so this position is a natural fit.

AR: Alabama has a football team—who knew? More seriously, you mentioned teaching introductory courses in business statistics for undergraduates. That’s a very large and important student audience for statistics teachers nationwide. What do you think are the most important ideas and skills for these students to learn, and do you think most introductory course and textbooks achieve these goals?

JC: I certainly agree—I think this is the statistics instructor’s most important audience, and the importance of this course continues to grow as emphasis on analytics increases. This is our opportunity to dramatically enhance our students’ numeracy—their comfort with and ability to understand and use data. In addition to being able to work intelligently with and interpret data, I want my students to develop some ability to think statistically.

Statistical thinking is simple yet sophisticated—the logic of concepts such as confidence intervals, hypothesis testing, and p-values appear to be very straightforward, but are actually very subtle and intricate. The frequentist notion that we can calculate the frequency with which repeated confidence intervals will contain the value of some parameter if they are derived from independent samples taken from a population using an identical sampling process is strikingly beautiful. The central limit theorem for sample means is stunningly elegant. The logic of hypothesis testing is exquisite. I suspect that many of my brethren in statistics education agree with me on these points. I think the key to teaching elementary statistics—and this may be the key to all education—is enabling students to see our discipline—or any discipline—in this way.

How do we help students see this? There are many effective ways to explain and demonstrate statistical concepts, but statistics instructors have to go beyond explaining and demonstrating. If we want our students to begin to think statistically, we have to help them appreciate the power of statistical thinking. And very, very few of our students will appreciate the power of statistical thinking if we do not show them that we appreciate the power of statistical thinking. I am not advocating in any way that we try to sell statistical thinking to our students, but rather that we give them access to the beauty of statistical thinking. This means we must boldly share our feelings about the discipline with our students.

I achieve deeper insight into some aspect of statistical thinking every time I teach any statistics course—including introductory statistics for undergraduate students. I still marvel at the brilliance of the discipline and at what we can do with the tools of statistics. This is why I decided to earn a Ph.D. in statistics and return to academia. Again, I suspect that many of my brethren in statistics education share my feelings. So why not share these feelings with our students? How can we expect them to appreciate statistical thinking if they are not convinced that we appreciate statistical thinking? I know many statistics instructors who loathe teaching introductory statistics. I do not understand this—I love teaching introductory statistics. These courses give me unique opportunities to discuss fascinating ideas at a very conceptual level with people who I hope will become interested in the subject. Many people characterize introductory statistics as a math course; I see it as a course about logic and ideas and thinking and communicating.

One simple way I demonstrate the importance of numeracy to students in introductory statistics courses is ask them to determine the minimum number of votes a candidate for U.S. Presidency must receive to win the presidential election. I let the students discuss this among themselves for a few minutes—even after the results of the 2000 and 2016 Presidential elections, some continue to believe that the candidate who receives the plurality of votes nationwide wins the Presidency. I ultimately tell them the answer to my question is 12, and of course none believe me. I then ask them to imagine that only one voter cast a ballot in each of the following states: California, Texas, Florida, New York, Illinois, Pennsylvania, Ohio, Georgia, Michigan, North Carolina, and New Jersey. If the sole voter in each of these states voted for the same candidate, that would give the candidate 270 votes in the Electoral College, which is sufficient to win the U.S. Presidency—even if every vote in the remaining 37 states and the District of Columbia were cast for the other candidate. This extreme example forces students to confront the potential ramifications of the Electoral College and helps them to understand the importance of thinking about how decisions and policies may have consequences that the decision makers and policy makers may not have anticipated.

Teaching Business Students

AR: Thanks, Jim. Your enthusiasm and appreciation for our discipline are quite evident in this response. I think all of what you’ve said here applies to all students, not just business majors. Do you agree? Are there some statistical concepts and skills that you think are especially important for business students to learn in introductory statistics, as compared to (for example) biology or psychology or engineering students?

JC: I suspect that business colleges are a bit odd because of the extreme diversity of the disciplines they comprise. When you think of accounting, economics, finance, marketing,
management, management information systems, and operations management, what underlying statistical concepts are common to all? Some of these disciplines make heavy use of survey data, while others tend to collect data through experiments. Some rely primarily on cross-sectional data, while others generally rely on time series data, and longitudinal data are increasingly common. So the core statistical concepts I see as essential for business students are the same set of statistical concepts I see as essential for other disciplines. In my utopian university—U of U—every student would be expected to understand three broad core statistical concepts: the nature of data and how characteristics of data determine the types of graphs, summary statistics, and analyses that are and are not appropriate; the concepts of probability necessary to establish the foundation for statistical inference; and the basics of statistical thinking and logic, particularly with respect to inference. If all students understood these three core concepts, they could successfully move into other courses in which statistical concepts that are specifically relevant to their major are covered. These could be additional statistics courses, or they could be courses in their major that cover statistics within the context of some other discipline.

AR: What about statistical software? I suspect that business students use Excel for much of their coursework. Do you use Excel in your own teaching? Do you recommend using Excel or a different software product for teaching introductory statistics to undergraduates?

JC: Yes, business students do use Excel for much of their coursework, and so I use Excel’s functions and Analysis Tool Pack in my undergraduate introductory statistics course. Excel certainly has many limitations in this area, but it is ubiquitous and familiar, and it can be useful if the user understands its limitations. I use this as an opportunity to discuss with my students the need to understand the weaknesses of any software you use and the importance of selecting the most appropriate tool for a job, and I illustrate that point with examples from my research and consulting. I have also used JMP in this course with good results. I do discuss the strengths and weaknesses of various statistical software including SAS, R, Python, and Tableau, with the students in my undergraduate introductory statistics course.

I use SAS extensively in advanced courses in which the students are generally working on graduate degrees outside of statistics. I have been using SAS for almost 40 years in my research and in the classroom. In advanced courses in which the students are generally working on graduate degrees in statistics, I use both SAS and R. I use Enterprise Miner in the graduate-level data mining and machine learning courses I teach, and I bring Tableau and Python into the course when appropriate. I have also used both CPLEX and Gurobi in the optimization courses I have taught.

AR: You mentioned the growing emphasis on analytics earlier. May I ask you for a definition of that term? Has the rise of analytics changed what you teach, in introductory course or others? Are there analytics-related topics that you teach now, or think should be taught now, that were not taught a decade ago?

JC: I do not think there is anything close to a consensus on the definition of analytics. I use two definitions. For a long time I defined analytics as the transformation of data into insight that is accomplished through the application of the tools of data acquisition and management, data visualization, statistics, operations research, data mining, machine learning, and development of algorithms. This is analogous to describing a cake as flour, butter, sugar, and milk that are blended and baked until firm but not burned; it is more of a list of ingredients or components rather than a true definition, and so as a definition it is inadequate. More recently, I have moved to defining analytics as the scientific process of transforming data into insight for making better decisions. I think that this definition, which is consistent with the definition used by the Institute for Operations Research and the Management Sciences or INFORMS, communicates more clearly what analytics is and what analytics does. I use both definitions in professional presentations and classes in an attempt to be simultaneously as complete and succinct as possible.

Throughout my education, I studied both statistics and operations research—while working on my Ph.D. in statistics at the University of Cincinnati I took advantage of the terrific operations research faculty and courses in my department. I ultimately completed all of the coursework for a Ph.D. in operations research, took written and oral comprehensive exams in operations research, and completed a dissertation that focused on theoretical and practical issues that arise in problems at the interface of statistics and operations research. My dissertation committee even had cochairs—Marty Levy from statistics and Jeff Camm from operations research. So I have always naturally gravitated toward an analytics perspective in both teaching and research.

This manifests itself in a greater emphasis on visualization in my introductory undergraduate statistics course. In advanced statistics courses, I discuss the optimization that underlies various statistical methods. For example, it is relatively easy to show advanced students that ordinary least squares regression is a nonlinear optimization problem. From there, I like to transition into discussions of other potential error criteria for regression such as minimization of absolute errors or L1 norm condition, and the addition of constraints on the errors to the optimization model. This is not exactly analytics, but it helps students better understand important concepts and see relationships between statistics and operations research.

I turn this 180° in my advanced operations research courses. Instead of talking about how optimization is the mathematical foundation for many statistical methods, I talk about overlooked statistical aspects of optimization. Most constrained optimization problems are treated as deterministic problems; we assume to know the values of all model parameters with certainty. Optimization problems that are not treated as deterministic problems are often treated as stochastic optimization problems; we assume to know the probability distributions of all models parameters that are not deterministic. However, many constrained optimization problems are neither deterministic nor stochastic; we do not know the value of at least one model parameter with certainty and we do not know its probability distribution. In those cases, sample data are often used to estimate the values of these model parameters. The solution to
the resulting model is only an estimate of the optimal values of the decision variables and the associated value of the objective function. And the estimated optimal value of the objective function has a sampling distribution with variance and bias. These can be important considerations for decision makers.

AR: Let me ask more about your greater emphasis on data visualization in introductory courses. Do you introduce your students to more visualizations than the standard graphs (e.g., histograms, boxplots, and scatterplots) for univariate and bivariate statistics?

JC: I do introduce students to several visualization tools beyond the standard graphs. But before I discuss various visualization tools, I discuss hue, saturation, and intensity and their potential impact on how a graph is interpreted. I talk about a single hue progression, diverging schemes, and categorical color keys and their potential impact on the message a graph delivers. I talk about the number of qualitative and quantitative variables that can reasonably be included in a graph, and the trade-off between the amount of information presented and the clarity of the message. And I talk about motion and audio enhancements and how they can, when used carefully, depict variables that do not otherwise appear in a graphical display.

Once the students have some understanding of these concepts, I begin discussing various visualization tools. In addition to the standard graphs, I discuss bubble charts, parallel coordinates plots, spider charts, heat maps, and star glyphs. I have occasionally brought examples of Chernoff faces into class to demonstrate a creative approach to multivariate visualization. I walk students through how and why I developed change-point plots to demonstrate simultaneous consideration of several characteristics of the distribution of a single variable. I also use this opportunity to show that it is perfectly acceptable to create a new type of chart if you carefully consider how it will actually communicate a message.

Finally, I provide examples of data dashboards visualizations that utilize motion and sound, and I show students real errors made by politicians and reporters when using various visualization tools.

AR: I have to confess that you’re using some terminology that I’m not familiar with. Can you explain, perhaps with an example, what you mean by single hue progression, diverging schemes, and categorical color keys?

JC: Sure. In a single hue progression, the value of a variable is represented by a progression of the brightness or saturation of a single hue. As the value of the variable represented by the hue increases, the brightness or saturation level of the hue increases. A diverging scheme uses two different hues at the endpoints of the progression; as we move from the low end to the high end of the progression, the hue on the low end fades and the hue on the high end intensifies. This works particularly well if you select primary colors (blue, red, yellow) as the hues on the ends of the progression. For example, if you use blue for the hue on the low end of the progression and red on the high end of the spectrum, as you move through the progression you start with pure blue and no red, then move through shades of purple comprising less blue and more red until you reach the high end of the progression, where you end with pure red and no blue. We frequently see this approach used during leap years to represent the relative support of the Democratic and Republican nominees for President in each state prior to the election.

These approaches are effective ways to use hue to add information on quantitative variables to graphs and other displays. On the other hand, in a categorical color key we use different hues to represent different values of a categorical variable. We frequently see this approach used during leap years to represent whether the Democratic or Republican nominee for President won in each state after the election; a state is blue if it was won by the Democratic candidate, and red if it was won by the Republican candidate.

AR: You have coauthored some business statistics textbooks. How did this come about, and what are some distinctive features of these books?

JC: My coauthors and I currently have seven textbooks in print: four in statistics, two in operations research, and one in analytics. Other than the analytics textbook, each of these books was originally authored by Dave Anderson, Dennis Sweeney, and Tom Williams. Dave was my department chair during my first 2 years in the Ph.D. program at the University of Cincinnati, and I was Dennis’ graduate assistant for those same years. When Dave, Dennis, and Tom decided they wanted to bring new authors aboard, they asked Jeff Camm to join them. Jeff was cochair of my dissertation, and I worked with him regularly after I received my Ph.D. I had been educated in statistics and operations research, I had taught both statistics and operations research courses at all levels, I had published research in statistics and operations research, and I was familiar to the authors of these books; I suspect these were the factors that led to them inviting me to join this authorship team. Soon after, we added Mike Fry and Jeff Ohlmann to the authorship team, and that is where we now stand. This has been a terrific experience for me. Writing and revising textbooks is hard work, but my coauthors are talented, articulate, diligent, and responsible, and they are good friends who are fun to work with.

The market for introductory statistics, operations research, and analytics textbooks is very competitive; there are many good options for instructors to consider. We work very hard on the quality of exposition; we strive for correct, clear, concise, and complete explanations. We also use current problem scenarios for our examples and exercises—we replace approximately one-third of the exercises in each revision of each book. We also provide several cases at the end of each chapter, and we focus on interpretation of the results. Our publisher, Cengage, also provides the MindTap online digital learning platform. Mindtap provides students with mobile access to chapter readings and accompanying videos, interactive visualizations that help teach important statistical concepts, and algorithmically generated homework assignments that give students the opportunity to work as many unique problems as they wish.

AR: Your scholarship has also extended into sports statistics. What are some of the questions you’ve tackled (so to speak) in that area?
I have worked with colleagues and students to apply Bill James' Pythagorean Method for baseball, which relates a major league baseball team's winning percentage to the ratio of the square of the runs it has scored to the sum of the squares of the runs it has scored and the runs it has allowed, to hockey, soccer, and lacrosse. A student and I executed an event study to estimate how long it takes before the economic impact of putting a major league franchise in a new city dissipates—it takes surprisingly little time. I have published some papers on using sports in the classroom. One article highlights how to use the Strat-O-Matic baseball board game to teach basic probability, and another describes a case I wrote that requires students to use integer programming to demonstrate the feasibility of Simpson's paradox during Major League Baseball's 1981 season that was split due to a players' strike.

I have had the good fortune to work with writers on interesting stories for the Wall Street Journal, New York Times, Washington Post, Chicago Tribune, Seattle Times, Boston Herald, U.S. News & World Report, Associated Press, Reuters-Thompson, BBC, NPR, and Real Sports with Bryant Gumbel. I have also published two anthologies of statistics in sports with Jay Bennett and Jim Albert. These anthologies are collections of research in this area published prior to 2000 and from 2000 through 2004. We are now working with Oxford Press on anthologies for 2005 through 2009 and 2010 through 2014.

**International Impacts**

**AR:** Shifting gears, let me ask about your work with the Statistics without Borders organization. Were you one of the founders of that group? What motivated you to create this organization?

**JC:** Yes, I worked with Fritz Scheuren, Gary Shapiro, and Steve Pierson to establish Statistics without Borders. We each saw the potential for improving the welfare of others by applying statistics to problems of societal importance, and we each also saw the desire of many members of the ASA to work on these types of problems. Much of my motivation came out of an unlikely place—New Orleans. I was the General Chair of the 2005 INFORMS Conference, which was scheduled to be held in New Orleans in early November of that year. In late August of 2005, Hurricane Katrina devastated New Orleans, and Hurricane Rita followed soon after. We had to revise our plans and move the INFORMS conference, with its 3000-plus attendees, to another city in less than 10 weeks. We fortunately found two adjacent hotels in San Francisco that could combine to host the conference, and we made all of the new arrangements with very little time to spare. I was relieved that we did not have to cancel the conference, but what stayed with me from this experience was how quickly I had watched a large populous region of the United States, the wealthiest nation in the world, reduced to horrifying desperation. The conference was very successful, and we organized a drive that raised a lot of money for victims of the hurricanes, but I could not shake the memories of the suffering I had witnessed.

It was not much of a leap from there to thinking about the extreme conditions people in developing nations around the world face on a regular basis. After the conference concluded, I began doing pro bono work on projects with several NGOs, and it struck me that many other members of the ASA might appreciate the opportunity to work on similar projects. I contacted my friend Ron Wasserstein, who is the Executive Director of the ASA, to discuss the potential establishment of an ASA group that would help ASA members find these kinds of opportunities, and he informed me that Fritz, Gary, and Steve were kicking around a similar idea. Fritz called me a few days later and graciously invited me to join him, Gary, and Steve. Soon after, we established Statistics without Borders and began informing ASA members about the new group through the always supportive AMSTAT News.

We held our first official meeting at the 2009 Joint Statistical Meeting in Washington, D.C., and it was inspiring. The room was packed, and the current ASA President, ASA President-Elect, and several past ASA Presidents were there. It would be an understatement to say the attendees were enthusiastic! During this conference, Statistics without Borders was also featured in a story in the lifestyles section of the Washington Post on August 5.

Statistics without Borders' first major project involved estimating the extent of damage to homes and dwellings in Haiti immediately after the horrific earthquake the nation suffered in January of 2010. After that project, Statistics without Borders’ membership increased rapidly and now includes over 1500 concerned statisticians who want to use statistics to improve the quality of life for others. I was privileged to serve with Gary Shapiro as the group's cochair during 2012, and also to work with Fritz and Steve and this was one of the most gratifying experiences of my career.

**AR:** Has this organization taken on projects directly related to statistics education?

**JC:** I am not aware of any instance in which Statistics without Borders has taken the lead on a project directly related to statistics education, but it has provided assistance with statistics education projects. In the highest profile efforts of this kind, Statistics without Borders’ leadership helped identify instructors for the Pyongyang Summer Institute in Survey Science and Quantitative Methodology in North Korea. The Pyongyang Summer Institute is an intensive, international teaching program at the Pyongyang University of Science and Technology that is run by Asaph Young Chun. It was launched in the fall of 2010, and it is the first and only private and international university in North Korea. I have also occasionally looked to Statistics without Borders to find colleagues who can give workshops for the International Teaching Effectiveness Colloquium series that I organize in developing nations.

**AR:** Please tell us more about this workshop series. Which countries have you held these in? What do the workshops focus on?

**JC:** I created and established a domestic series of annual workshops called the Teaching Effectiveness Colloquia or TEC for INFORMS in 1999. In these colloquia, we feature several 60-minute workshops on how to make operations research, statistics, and analytics education more engaging and effective. Workshop topics include teaching with technology, issues in
distance learning, collaborative learning, active learning, writing and teaching with cases, project-based learning, teaching modeling skills, flipped classrooms, etc. Through these events, we also strive to encourage the application of operations research, statistics, and analytics to societal problems. The INFORMS TEC are held immediately prior to the annual INFORMS Conference, and they are very successful and very popular. During the years I chaired the TEC, they attracted 35–50 participants. INFORMS will host its twentieth annual TEC in November of 2018.

At the conclusion of the 2005 INFORMS conference, I decided to try to extend these workshops outside of the United States and Canada. These international TEC are hosted by operations research societies outside of the United States and Canada, are held immediately prior to or during the host organization’s conference, and are structured to accommodate the interests, schedule, and budget of the host organization’s members.

Through this extension of the TEC, we feature two or three 60-minute workshops given by highly regarded instructors from the United States, Canada, and Europe, and we work to also incorporate workshops given by two or three members of the host organization into the program. We have organized and held international TEC in Uruguay, South Africa, Colombia, Tanzania, India, Kenya, Argentina, Cameroon, Croatia, Nepal, Cuba, Fiji, Mongolia, and Moldova.

As a result of the TEC we organized in Ulaanbaatar in 2016, 17 educators and government statisticians from Mongolia came to Tuscaloosa in May of 2017 for an extensive workshop on teaching basic statistics, operations research, and analytics. Over 2 weeks, several highly regarded educators, including Chris Franklin, Roxey Peck, Bruce Barrett, Jef Naidoo, Dwight Lewis, Cali Davis, Ken Chelst, Dave Goldsman, Tom Edwards, and Brad Casselman each gave a 1-day workshop on teaching a topic in statistics, operations research, or analytics. After our colleagues from Mongolia returned home from this event, they created a high school statistics curriculum and an accompanying workbook for their nation that will be introduced in June of 2018.

I am now working on scheduling international TEC in Ghana, Laos, Bulgaria, Russia, Zimbabwe, Namibia, and Cambodia over the next several years. These international TEC are a terrific way to build bridges across cultures and establish cross-cultural working relationships.

AR: Congratulations on this very impressive outreach. I can imagine (or maybe I can’t) some of the logistical difficulties that you’ve had to overcome. Can you share one illustrative example of this?

JC: Sometimes things don’t go as planned, but that is true of all conferences and events—anywhere in the world. The hosts always work hard to ensure the success of the international TEC they are hosting.

I could tell the story of the strange circumstances led me to be a guest at the state funeral for a Nobel Peace Prize winner and meet Archbishop Tutu at the funeral. It is a good story, but it would take several pages to complete.

On a trip to Tanzania, my host failed to pick me up at Julius Nyerere International Airport outside of Dar es Salaam. After waiting for about an hour late in the day outside the terminal in an extremely chaotic environment, a gentleman who was waiting to pick up friends arriving on the next incoming international flight struck up a conversation with me. He told me he was from Michigan and had moved to Tanzania to work for an NGO, he was picking up four wedding planners who were coming to Tanzania for a short mission for their church, and he was headed to the same group of hotels as I after he picked up his friends. He offered to give me a ride, but I politely refused—he was a complete stranger, and I wanted to wait for my host to pick me up. About an hour later, I watched four very tired young women dressed in frilly dresses and hats exit the airport. Their appearances convinced me that they were wedding planners who were coming to Tanzania for a short mission with their church—and had likely never before travelled internationally—so when he again offered to give me a ride, I accepted.

After I climbed into his jeep—in the front of the vehicle on the passenger side—I noticed that he shifted gears with his right hand. Because you drive on the left side of the road in Tanzania, this required him to reach across his body every time he shifted. Then I noticed why he would reach across his body to shift gears—he was missing his entire left arm! He steered with his knees when he needed to change gears.

He must have noticed my horror and reassured me, smiling and telling me “Don’t worry—I have been driving like this for several years. I lost my left arm a long time ago when a large tree I was cutting down fell across my shoulder, and I have adjusted. You’ll be fine!” About the point at which I started to become somewhat comfortable with his unique approach to driving a standard shift vehicle, his cell phone rang. He reached into his pocket, pulled out his phone, and answered it! Now he is steering his jeep, shifting his gear, and using his phone all with one hand. I never did find out why he didn’t purchase a vehicle with an automatic transmission!

Ninety minutes later, I arrived at my hotel. I eventually learned that another guest was due to arrive about 3 hr after I arrived, and my host had decided to pick us up at the same time. If I had waited at the airport for another 45 min, my host and I would have connected.

AR: That’s quite a story! I’ll resist the urge to ask about your attending a state funeral, but I will ask some more follow-up questions: How have you managed to make connections with statistics teachers in these countries in the first place? How do you fund this work? Have some of them kept in touch and let you know about a lasting impact of your efforts?

JC: I have connected with colleagues around the world in many ways. In some instances, colleagues have reached out to me—perhaps because I served as editor in chief of the open-access journal *INFORMS Transactions on Education* for several years, perhaps because of my role with Statistics without Borders, perhaps because of my role with the *Wiley Encyclopedia of Operations Research and Management Science*, perhaps because of the textbooks I have coauthored. Occasionally an officer of a professional society in another nation or someone working for a foreign government will contact me. U.S. Ambassadors who are interested in having me work with colleagues in the nations in which they serve have contacted me.
Social media is useful for making connections—LinkedIn is a terrific resource. And in many instances, when I learn of a real problem in a developing nation that I think statistics and operations research could figure prominently in resolving, I search for an professional society, academic department, or government agency that could help me establish a relationship with colleagues with whom I could work on the problem. I have been invited to give plenary talks and workshops at conferences, served on dissertation committees for Ph.D. students, and served as a reviewer for grant proposals for granting agencies in several nations. These opportunities also give me insight into important problems in other countries, and they often lead to the organization of TEC.

Money is always an issue when organizing an international TEC. INFORMS and the International Federation of Operational Research Societies (IFORS) generously provided very helpful financial support for the first 6 years of this initiative. If the conference or professional society we are collaborating with can afford to do so, it will cover the cost of the speakers while they are in the host nation—food, lodging, taxis, etc. Occasionally my hosts will arrange for me to visit a local university and give a workshop or a series of lectures; that will often take care of the largest expense—the flight. The government of the host nation or the U.S. Embassy in the host nation has assisted us on a few occasions. However, in many instances the speakers must bear the costs associated with participating. I am fortunate to have many friends in the statistics and operations research communities who believe in this initiative and are willing to use their own funds to pay for their expenses.

I encourage those who give workshops for the international TEC to arrive several days before the conference or stay several days after the conference and use that time to travel throughout the host nation. This is an incredible opportunity for them to see places that few people from our country will ever see, and it fosters the new relationship between them and our hosts.

It is important to note that, whether or not my hosts are paying for any of my expenses, they always look after me and take care of me. I rarely have to find a cab or worry about how to get from the hotel to an airport, a conference venue, or a reception because my hosts take care of those details for me. They also keep me out of trouble—I am often distracted by my surroundings and I sometimes do not pay as much attention to where I am as I should, but my hosts do not let me wander into places that might be dangerous.

I have visited over 40 nations since I established this initiative, and I routinely keep in touch with and work with friends in almost all of the nations I have visited. My friends from these nations do periodically update me regularly on their progress with education programs, applications, and initiatives to strengthen official statistics in their nations—they are doing great work! Other opportunities to work with these friends often arise. During the spring semester, my college hosted a visit by a good friend of mine from Zimbabwe through the Fulbright Scholars program; he worked with our faculty on several research projects as well as the design of an Honors program in operations research that Zimbabwe’s National University of Science and Technology will soon offer. We have a visit by a friend from Ecuador scheduled for this fall, and we are trying to work out the details for a visit by a friend from Albania.

**Pop Quiz**

AR: Now let’s begin the “pop quiz” portion of the interview, where I’ll ask a series of short questions and request that you keep your responses brief. First, please tell us about your family.

JC: I grew up in a small town between Dayton, Ohio, and Richmond Indiana. My parents were very kind and decent people. I am the oldest of five children; I have three brothers and a sister. The home I lived in throughout my childhood bordered a farm, and I lived in that home while I worked my way through school at Wright State University. I have a wonderful wife who is very compassionate and understanding; we have been married for 33 years, and we have lived in Ohio, Louisiana; California, and Alabama.

AR: What are some of your favorite travel destinations? Perhaps you could mention one place you’ve been for professional reasons and one strictly for pleasure.

JC: I have travelled to over 40 nations for professional reasons, and I always try to take some time to see a few sites on these trips—and my hosts usually overindulge me in this regard. Every nation has a lot to offer a visitor, so I don’t think I can select a single favorite travel destination for professional reasons. My top four, in no particular order, are Chile, South Africa, Cuba, and Mongolia—but I have greatly enjoyed the people, culture, food, and landscape of every country I have visited.

I am a big fan of the U.S. national park system, and my favorites include Yosemite and Arches, but my favorite travel destination strictly for pleasure is Alaska. My wife and I took a vacation there several years ago and had a great time—it is staggeringly beautiful.

AR: What are some of your hobbies outside of statistics and education?

JC: I played competitive fast pitch softball for several years while I lived in Ohio; 1 year, the team I played for placed in the top four in the national tournament. I like hiking, photography, gardening, reading, music, and classic movies. I used to enjoy repairing automobiles, but automotive technology has moved far past me.

AR: Your choice: please name either some books that you’ve seen, recently.

JC: I recently started The Passage to Power. It is the fourth book in Robert Caro’s planned five volumes on Lyndon Johnson. I read the first three volumes—The Path to Power, Means of Ascent, and Master of the Senate—over the past several months, and I look forward to his fifth volume. The next book on my reading list in Nicholas Coghlan’s Collapse of a Country: A Diplomat’s Memoir of South Sudan. Nick is a former Canadian diplomat who has written extensively about his work in very troubled regions. His books are insightful and engaging.

AR: Now for a fanciful question: You can have dinner anywhere in the world with three companions, but the dinner conversation must focus on teaching statistics. Who would you invite, and where would you dine?
A. ROSSMAN AND J. J. COCHRAN

Over the past few decades, I have been fortunate to work with many great statisticians. One of the most influential in my life was C. R. Rao, who was a mentor and a close friend. He played a significant role in shaping my career and has been a source of inspiration throughout my professional journey.

In addition to Rao, I have had the opportunity to work with Brad Efron, a statistician who has made significant contributions to the field. Efron is known for his work on the bootstrap method and has been a major influence in the development of modern statistical techniques.

Another influential figure in my career has been Donald Morris, a statistician who has made important contributions to the theory and practice of statistical inference. He has been a mentor and a friend, and I have learned a great deal from him.

In terms of teaching, I am most proud of my work in the field of statistics and operations research. I have had the opportunity to work with many great teachers and have learned a great deal from them. Some of the colleagues with whom I most enjoy discussing statistics education are those I have worked with on education issues and initiatives such as the Beyond AP Statistics workshops—people such as you, Chis Franklin, Roxy Peck, Beth Chance, Ron Wasserstein, Jackie Dietz, Joan Garfield, Robin Lock, V. A. Samaranayake, Jessica Utts, Denise Lievesley, and Dick Scheaffer. Bob Hogg was very generous with his time and thoughts, and he had some terrific ideas about teaching statistics. I learned a lot about teaching from my dissertation coadvisors, Marty Levy and Jeff Camm; they each are a tremendous resource.

Looking back on your teaching career, please comment on one aspect of your teaching that has changed over the years. And perhaps the harder counterpart to that question: tell us about one aspect of your teaching that has not changed.

JC: The colleagues with whom I most enjoy discussing statistics education are those I have worked with on education issues and initiatives such as the Beyond AP Statistics workshops—people such as you, Chis Franklin, Roxy Peck, Beth Chance, Ron Wasserstein, Jackie Dietz, Joan Garfield, Robin Lock, V. A. Samaranayake, Jessica Utts, Denise Lievesley, and Dick Scheaffer. Bob Hogg was very generous with his time and thoughts, and he had some terrific ideas about teaching statistics. I learned a lot about teaching from my dissertation coadvisors, Marty Levy and Jeff Camm; they each are a tremendous resource.

AR: Let’s go from fanciful to ridiculous: If you could travel to any point in time, past or future, what would you choose, and why?

JC: The last question in the pop quiz consists of four questions with which I collect data from students. The binary question is: Do you consider yourself an early bird or a night owl? The nonbinary categorical question: On what day of the week were you born? (You might consult www.timeanddate.com.) A discrete variable comes from asking: How many of the seven Harry Potter books have you read? And finally a question about a continuous variable: How many miles from where you were born do you live now? (You might consult www.distancefromto.net.)

AR: The international TEC, EORMS, and ITE, have been coordinated so they provide our colleagues in developing nations with course content, classroom support material, and opportunities to share teaching methods. The overriding objectives of this coordination are to help statistics and OR societies in developing nations grow and encourage the application of statistics, OR, and analytics to societal issues.

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JC: I am tempted to select a point in the future to allow me to see some of the great advances statistics and society will have made, but I think I would return to 1960 and work on John Kennedy’s presidential campaign. My wife’s grandparents ran JFK’s campaign office in Dayton, and the energy and hope that they described emanating from that campaign is incredible. I think that President Kennedy’s 1961 inaugural speech set the United States on a path of service to others—domestically and internationally—that the nation stayed on until the 1980 election, when Ronald Regan ask us to consider “Are You Better Off Than You Were Four Years Ago?” I think that the United States is at its greatest when those who have had good fortune reach out to help those who have not been as fortunate, and I would enjoy being a part of a presidential campaign that shared that outlook.

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Even with all of these changes, teaching is and always will be primarily communication. What has not changed for me is my commitment to making statistics accessible to students and demonstrating its incredible potential for resolving real problems to them.

AR: Now let me ask you to look 10 years into the future. What changes would you like to see in the teaching of statistics in the next decade? And just in case they are not the same thing, what changes do you expect to see?

JC: First, what I would like to see is statisticians teaching introductory statistics courses. Would a department chair be comfortable assigning an instructor who does not have an accounting degree to teach an introductory accounting course solely on the basis of the one or two accounting courses the instructor had taken at some point in her or his education? Is this commonly done in biology or architecture or law or medicine or civil engineering courses? Introductory statistics is often taught by the member of a department who has drawn the short straw. If the instructor does not want to teach introductory statistics or has a poor grasp of the subject, students in the class will quickly sense this, and then what are students to conclude? This tells students that statistics is not very important, it tells them that statistics is difficult and confusing, and it tells them that statistics will not be useful to them.

Second, what I would like to see is statistics integrated into primary and secondary education. Statistics is an integral component of numeracy, and numeracy is critical to successful careers and good citizenship. I look forward to seeing the impact that Mongolia’s new high school statistics curriculum will have on the nation’s culture and economy. I would also like to see statistics become part of the core curriculum across colleges and universities. Our discipline is the foundation of all science— inference is the practice of the scientific method—and it deserves a prominent place in colleges’ and universities’ academic programs.

What I expect to see is a fragmented, piecemeal approach to what I would like to see. Some school systems will integrate statistics into their primary and secondary school curricula. Some colleges and universities will add statistics to their cores. Their students will be more successful because of these changes. Sadly, most school systems, colleges, and universities will likely not make these changes until they see what they consider solid evidence that the students from other school systems, colleges, and universities are outperforming their students because of these curricular same changes.

I used to believe this would be a slow evolutionary process, but the emphasis business is now placing on analytics gives me reason to be optimistic. This phenomenon may greatly accelerate the rate at which these curricular changes occur.

What is obvious to statisticians is not so obvious to most of those outside of our discipline, but I do believe these changes will eventually occur—and perhaps sooner than I believed only a few years ago.

AR: Thanks again, Jim, for taking the time to answer all of my questions so thoughtfully. I especially appreciate your insights from an operations research and business analytics perspective. My final question is: What advice do you have for JSE readers who are just beginning their careers as statistics teachers and/or education researchers?

JC: Thank you for this opportunity, Allan. As always, I have enjoyed interacting with you!

My advice for JSE readers who are beginning their careers as statistics teachers and/or education researchers is to experiment in the classroom. Be bold and try something new or different. You will likely be surprised by how well your efforts work, and even if your efforts occasionally don’t work exactly as you planned, you will learn something from the experience and your students will really appreciate the thought and effort you have put into improving the quality of their education.

I would also advise JSE readers who are beginning their careers as statistics teachers and/or education researchers to get involved with the ASA’s section on statistical education. The section’s members are some of the kindest, most helpful, and most sincerely concerned people I have ever met, and I have benefited greatly from my involvement with the section. JSE readers who are beginning their careers as statistics teachers and/or education researcher should attend the JSM sessions organized by the section, attend the section’s business meetings, and talk to the sections members and officers. This advice extends to the International Statistical Institute’s International Association for Statistical Education. This is another group of very helpful people who are dedicated to improving statistics education.