Interview with Christine Franklin

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This interview took place via email on August 16, 2013 – October 9, 2013.

Beginnings

AR: Thanks very much, Chris, for agreeing to be interviewed for the Journal of Statistics Education. *How did you come to study statistics?*

CF: Allan, I am so appreciative of this opportunity to share my devotion to statistics education with you and the readers of *JSE*. My plan as an undergraduate student was to pursue a career in law. As a political science major, I found that the elegant problem solving in mathematics and statistics courses (initially taken as electives) was a refreshing alternative to the nuances of politics and law. I also began to understand the importance of statistics in the field of political science. A month away from attending University of North Carolina Law School, I made the decision to attend graduate school in mathematics and statistics. My goal with that decision was to pursue a career in public administration utilizing my undergraduate studies in political science

and graduate studies in statistics. During my graduate career, I was a teaching assistant and began to experience a fondness for teaching and academia. After graduate school, I was offered a faculty university position teaching both statistics and mathematics and my professional path changed again. Thirty-four years later, it was the best decision I could have made.

AR: Where did you attend graduate school, and can you tell us more about the teaching assistant experience that kindled your interest in teaching?

CF: I attended graduate school at the University of North Carolina – Greensboro (UNC-G). As a teaching assistant, I was given full teaching responsibility for several sections of the undergraduate introductory probability and statistics course. At that time, the introductory course was being taught as a "water downed" math stat course. Given my motivation for pursuing graduate work in statistics, I advocated teaching the intro course as more of a problem solving and conceptual course. I was given some flexibility but still the mathematical flavor of the course stayed prominent. I discovered teaching was both challenging and gratifying. And in my naivety, I believed I could easily assist in changing the priorities of teaching statistics at the undergraduate level. ☺ When UNC-G offered me a lecturer position, I accepted and began also teaching the mathematics course for elementary teachers – my first experience working with students training to teach at K-12.

AR: How long did you stay at UNC-G, and how did you find your way to Gainesville, Florida?

CF: I was on faculty for two years at UNC-G, then four years at West Virginia University Institute of Technology, and then I made my way to Gainesville, Florida for three years. I traveled with my husband during his post-medical school training. During my time at WV Tech, I primarily taught math and statistics courses for engineers, and I helped to establish new statistics courses for the math department. When my husband accepted a pulmonary fellowship at the University of Florida, the statistics faculty, with Dick Scheaffer as department head, hired me as a lecturer in 1986. What a magical place to land for changing the culture of how to teach the introductory course! I used the Freedman, Pisani, and Purves text and then class tested the new Moore and McCabe *Introduction to the Practice of Statistics.* Dick Scheaffer introduced me to the developing focus on more statistics at K-12 and Alan Agresti began planting seeds about how we needed to one day write a textbook that emphasizes categorical data for the general introductory course.

AR: Wow, those two seeds about K-12 statistics and an introductory textbook eventually bore considerable fruit! I'll ask about those later, but let's finish your academic path first. How did you end up at Georgia following Florida?

CF: When my husband completed his pulmonary and critical care medical fellowship, he was offered a wonderful medical practice opportunity in Athens, Georgia. At the same time, I was offered an exciting faculty opportunity in statistics at the University of Georgia (UGA) I was Bob Taylor's first faculty hire in his new role as department chair. Bob became a dedicated supporter and participant in statistics education – one of my heroes. Although neither my husband nor I wanted to leave Gainesville, the career opportunities in Athens placed us closer to our families in North Carolina – a top priority for both of us. I am now beginning my 25th year

at UGA and have two "Georgia bulldog" sons, Corey and Cody. The support UGA has given me to promote statistics education has been phenomenal.

Teaching Style and Philosophy

AR: How did your teaching style and philosophy change over these beginning years? What were your classes like at first, and what was different by the time you reached Georgia?

CF: It is my belief that the textbook dictates heavily the content and pedagogy for teaching a course. The culture of one's academic home is another important influence. In my beginning years of teaching, the textbooks used were more formula-oriented with little emphasis on learning concepts and interpreting findings. The norm was to teach a course as a laundry list of topics where students depended more on hand calculations and rote memorization rather than developing statistical reasoning skills. Although I instinctively knew what I wanted my teaching philosophy to be for the intro course, implementing that philosophy was not natural. My years at UFL dramatically changed my teaching style. I attribute this to (1) a culture among my colleagues who valued the intro course being more about learning concepts and statistical reasoning, (2) using the Freedman, Pisani, and Purvis textbook, and (3) accessible technology – I utilized the statistical software MINITAB that was developed in the 70's (the original line command version). By the time I left UFL and began teaching at UGA, I knew I could not return to the "traditional style" intro course. My goal was to continue teaching a course focused on statistical concepts and reasoning skills using appropriate technology and activities oriented to investigative learning and problem solving. I wanted my courses to center around real world case studies. This has been a continuing work in progress for the past 24 years at UGA.

AR: You're making my role here too easy, because now I have to ask you to describe how your changes in teaching style and approach have continued at Georgia.

CF: Foremost with my teaching, I aspire for all my students to feel that I care about them as individuals and desire success for them in the course and advancing their future goals. I want them to appreciate the beauty of statistics and to be comfortable with critical thinking. I have tried to maintain the teaching philosophy that our introductory courses should promote statistical literacy and help students build a solid foundation in the skills needed to reason statistically for daily living. So the "work in progress" has been how best to deliver this type of instruction with such challenges as what a home department has set as the expectations of the introductory course (possibly more of the traditional style discussed earlier), the expectations of other client departments on campus (maybe preferring the laundry list of distribution based inference tests), the available technology, the size of the classes (large lecture versus smaller), and the assessment used. Most especially with the smaller sections I have taught (including the courses developed specifically for K-12 teachers), over time I have seen my courses and teaching style become primarily one of investigative learning through hands on activities, using simulation, introducing concepts through case studies, and from week one, using simulation to allow students to visualize the big picture of the statistical investigative process. It is now week two of my classes and we have demonstrated and discussed the different types of distributions (population, data, and sampling), the concept of margin of error, and next week, we will investigate P-values and type 1 and 2 errors. Simulation and randomization tests with case studies make all this possible.

We have also been exploring data sets and discussing study design. Through the use of applets and graphing calculators, technology is available every class period. I am finally at a comfort level of not feeling the pressure to cover a multitude of distribution based inference tests in the first course. I am more concerned with students understanding the concepts mentioned above, knowing how to design studies, using technology to explore the data, and then having the ability to communicate both orally and written their conclusions to the statistical questions of interest. I want my students to develop a healthy skepticism about how statistics is used in practice. But I am always fine-tuning and learning from my extraordinary colleagues better pedagogy to improve student success.

AR: You say that you have become comfortable with not covering a large number of distribution-based tests. Would you say that your colleagues, and perhaps more importantly those in client disciplines, also come around to that way of thinking?

CF: Some of my department colleagues have become comfortable, most especially my colleagues active in the statistics education community who attend teaching conferences (such as USCOTS) and the AP Reading. I am blessed to work with an amazing core group of devoted statistics educators. As for the client disciplines, recently my department surveyed the client departments to assess what they viewed as the statistical needs of their students. We found that they want not only an understanding of the distribution-based tests but also the conceptual understanding. Another big issue for client departments is having their students acquire proficiency in a statistical software package. Clients departments have expressed most concern at the graduate level for the service introductory first two courses. A wonderful consequence of this effort to understand client needs was forming a committee composed of faculty who are committed to teaching. One of the committee members, Kim Gilbert, who is active in the statistics education community, was able to inform the committee, for example, of new textbooks that could be used and how randomization tests might be incorporated into the courses. We are now teaching revamped intro service courses at the graduate level.

AR: You also mentioned that you feel more free to try new things in your smaller classes. Do you teach some large lecture courses also? If so, do you have strategies for creating student engagement and active learning in them?

CF: I last taught our large introductory course in Fall 2011. The course is a 4-hour course with 3 hours of lecture (200 or more students per section) and 1 hour of a 30-student computer lab section. The course has common computerized homework and computerized exams across all sections. We teach approximately 1500 students a semester. There is also a set of common lecture notes but instructors can vary from these notes. However, each instructor is responsible for having students prepared for common homework due dates and exam dates. Thus, there is not a lot of flexibility to deviate from the common schedule of content coverage. One way I discovered to bring in more student interaction within the large lecture is clickers and we are considering clickers for all sections of our large introductory course. The one-hour computer labs are devoted to computer activities so our students are exposed to a taste of investigative learning in the smaller computer lab section. The instruction in our large lecture class is also a work in progress with the coordinator and instructors continually discussing manageable pathways for more student engagement.

Textbook Writing

AR: You commented earlier that textbooks tend to drive the content and pedagogy of courses. You have co-authored a textbook, titled Statistics: The Art and Science of Learning from Data, *with Alan Agresti. What was your intention for this text in terms of influencing the content and pedagogy of introductory statistics courses?*

CF: When Alan and I first discussed the need for another introductory statistics book in the late 1980's, it was our belief introductory courses needed to focus more on categorical data. Traditionally, up until that time, primarily (or almost exclusively) textbooks focused on quantitative data. However, Alan and I advocated that in the world of everyday living (not just scientific research), most of our citizenry were exposed to categorical data. Also, we felt it was more intuitive for student understanding to use categorical scenarios for introducing many important statistical concepts such as sampling distributions, margin of error, and P-values. Our dream was to write a book that would promote statistical literacy and the ability to reason statistically. By the time we committed to writing this book around 2004 with the first edition published in 2007, the College Guidelines for Assessment and Instruction in Statistics Education (GAISE) document was published and endorsed by the American Statistical Association. We attempted to abide by our original goal of a balanced mixture of presentation for both categorical and quantitative data but also to support key recommendations of the GAISE guidelines from the College report:
- Emphasize statistical literacy and develop statistical thinking.
- Use real data.
- Stress conceptual understanding rather than mere knowledge of procedures.
- Foster active learning in the classroom.
- Use technology for developing concepts and analyzing data.

We rely heavily upon technology for working with real data sets, providing output in the text with very little calculations by hand, stressing the importance of writing and communication skills in interpreting the data analysis output, simulations to introduce statistical concepts, and hands on activities for investigative learning. Based on student input from many years in the classroom, we also have attempted to write a "readable" book with a wide variety of intriguing real data examples and exercises. We strive to connect all the examples and chapters to the real world and to emphasize how statisticians work "in practice." I have learned so much from my students over the years as to what their needs are for better understanding of the content. It was my students who encouraged me to use such pedagogical tools as margin boxes to simplify their learning of the content. Many students tell me learning Statistics is like learning a "foreign language." Thank you for the opportunity to speak about my textbook - I am very proud of this text. Like teaching itself, the textbook has been a work in progress. As we move toward the 4th edition, I see, for example, introducing more material revolving around randomization tests. Especially wonderful is that several of my close colleagues in statistics education have written excellent textbooks and today, in 2013, there are several choices for teaching a concept-driven, real world introductory statistics course. Best of all, we support each other in promoting and writing these textbooks!

AR: Can you give us some insights about the process of writing a textbook with a co-author? How did you and Alan divide up the work initially? How did you make the many decisions that must be made about what to cover when and how? How did you try to ensure that the final product would come across with one voice? How has the writing process changed with subsequent editions?

CF: I have often told friends and family that it was not possible to describe the full experience of giving birth to my sons – you actually have to live that process. I feel the same way about giving birth to a textbook – you have to live that experience. Writing a textbook was one of the most challenging aspects of my professional career but also one of the most rewarding. I cannot imagine writing a textbook alone. The collaborative piece between my co-author and I was essential to the success of fulfilling the goals of the book. Given that I was a first time textbook writer, I was fortunate to have Alan Agresti as my co-author and mentor – an internationally renowned statistician in categorical data analysis research, an experienced textbook writer, and a devoted teacher. We attempted to divide the division of labor based upon our strengths taking into account the many facets of a creating a textbook – writing the content, the pedagogy utilized in the text, developing the exercises, writing the instructor materials, and of course, the many facets of the production process. Alan and I outlined our core philosophy for the desired content and the presentation of this content. This outline dictated the initial drafts. However, once reviews came back, compromises often had to be made. This is when the decisions become more difficult – how to meet the needs and wishes of the potential textbook users but at the same time, not deviate too much from the core philosophy. Striving toward one voice occurs from the many back and forth versions Alan and I edited for each chapter. The most meaningful change in the writing process will occur with the upcoming 4th edition revision. Two new co-authors, Bernhard Klingenberg and Michael Posner, will join me in revising the textbook. Alan became an inactive author with the 3rd edition (I was on my own) but Alan continues to serve in an advisory role both with the current 3rd edition and for the upcoming 4th edition. I am excited about the new energy and vision Bernhard and Michael will bring to the textbook.

K-12 Statistics Education and AP Statistics

AR: Thanks for this informative look inside the textbook writing process. I promise not to ask about your childbirth experience. Let me shift gears a bit and begin to ask about the work for which you are best known and with which you have had a tremendous impact: your contributions to K-12 statistics education. You mentioned that Dick Scheaffer introduced you to the importance of such work while you were at Florida. What was your activity in the K-12 arena?

CF: ☺ Now to reflect back on my beginning exposure to K-12 activity in Statistics. It seems like yesterday but was over 25 years ago that Dick Scheaffer began exposing me to his efforts at K-12. Let me take this opportunity to say that Dick is the individual who has most influenced my professional career in statistics education, especially K-12. He is an incredible leader and statistician who has and continues to work tirelessly for K-16 statistics education. He and his wife Nancy have given generously in their friendship and support for my family through these many years and I am ever so grateful. Returning to UFL 25 years ago, Dick told me about a wonderful ASA committee of which he was a member called the Joint ASA-NCTM Committee on the Curriculum in Probability and Statistics and how the efforts of this committee were to

move Statistics to the K-12 school level. I listened to Dick rave about fellow committee members Jim Swift, Ann Watkins and Jim Landwehr, who have all been mentors and provided me the inspiration to believe that statistics must be part of the K-12 curriculum. Although I was primarily focused at that time on finding ways to create a more student friendly and useful introductory undergraduate statistics course, in discussions with Dick, I began to see where this committee was headed – to the importance of exposing students at K-12 to the basic ideas of statistical reasoning. It was during my time at UFL that the committee members I mentioned above wrote the first four booklets of the Quantitative Literacy series as a volunteer effort. Soon after, the committee was funded by the National Science Foundation to expand the series and to conduct workshops with teachers. It was in 1989 that NCTM included statistics and probability as a strand in the *Curriculum and Evaluation Standards for School Mathematics*. It was also in the year 1989 that I moved to the University of Georgia. Although I wasn't actively involved in K-12 at this time, Dick kept me in the loop of K-12 activity and began telling me about the possibility of a new Advanced Placement course in Statistics. Long story short, I kept my focus initially at UGA on the undergraduate introductory course but Dick stayed in contact asking me to become involved in the AP Statistics course in its early stages of development and implementation. I must mention that it is impossible for me to say "no" to Dick. The rest is history. I have dearly enjoyed my long involvement with AP Statistics. It was the work with AP that led me to understanding the urgency of teacher preparation in statistics for high school teachers, and then eventually moving my focus to statistics not just at the high school level but for all of K-12.

AR: Let's talk more specifically about your involvement with AP Statistics. What was your role at the first AP Reading, where the free response portions of students' exams are graded? And what was the overall experience of that first AP Reading like?

CF: The first reading in 1997 consisted of 47 readers and leaders. I served as a table leader and assisted on 2 -3 question teams. Although we were officially assigned only one question (as I recall), it was a family effort among the leaders to finalize rubrics for the six questions in 2 shorts days before the readers arrived. My most vivid memory of that first morning on the pre-reading days was Dick Scheaffer as Chief Reader discussing the leadership team's role in refining the rubrics. I raised my hand (fortunately I wasn't the only one) and asked, "What is a rubric?" The expression on Dick's face was priceless – one of oh no, this person is on my leadership team? Well, needless to say, I soon learned about rubrics and over the years, the rubric formats have been refined to an art. In 1997 I never imaged I would one day be in charge of drafting rubrics for several forms of the exam in my role as Chief Reader. Back to the first reading, on those pre-reading days, the leadership team was worried we wouldn't be able to complete the scoring of the exams in 7 days – all 7500 exams. My goodness, in hindsight, that seems like small potatoes compared to today where over 150,000 exams are graded in one week. What a phenomenal group of individuals at that first reading – dedicated college and high school teachers who went on to become future leaders at the AP readings. I was such a fortunate person to have these individuals become my friends and colleagues in statistics education. A bit of trivia – I was Roxy Peck's table leader at the 1997 reading. When I heard the news that Roxy would be the Chief Reader – Designate in 1998 shadowing Dick, I thought this might be my one claim to fame. ☺ Roxy has always been one of my biggest supporters and she truly has awesome power.

AR: And then of course you went on to assume the role of Chief Reader yourself for the 2008 and 2009 Readings, succeeding Brad Hartlaub who followed Roxy. Please tell me one (or more) thing you learned about teaching statistics from your involvement with the AP Statistics program.

CF: The AP Statistics community has shaped the earlier descriptions in the interview of my teaching style and philosophy. From 1997 – 2009, each June, I left my family for 11 days to participate in the AP Statistics readings. My husband and sons told friends and family I was going to "Stat camp." I always knew that when I returned from "Stat camp," I would be reenergized to teach for the new school year and that I would have gained new knowledge in content, pedagogy, and assessment for promoting better student learning. The uniqueness of the AP reading is the devoted collaboration between college and high school educators.

AR: One of the benefits for college faculty to work with the AP Statistics program is meeting so many top-notch high school teachers of statistics. These meetings often turn into friendships and sometimes into collaborations. One great example is your collaboration with Josh Tabor, which has led to co-authoring the book Statistical Reasoning in Sports (SRIS)*. Please tell us about this project and your interest in sports-related statistics.*

CF: I first met Josh in 1999 at the AP Statistics reading. It was his first year and I kept hearing from friends and colleagues how Josh was a fabulous young high school teacher and a rising star in the AP Statistics world. In the early 2000's, Josh and I were paired together at the reading as table leaders. By the end of that reading, I was completely in awe of Josh. I quickly came to understand that Josh is that unique teacher who brings an energy and excitement to learning, he is creative and visionary, he is well grounded in statistical content and pedagogy, and simply the nicest and kindest young man you will ever meet. He is also a sports nut like myself, especially baseball. During my tenure as Chief Reader, Josh and I served together on the AP Statistics Test Development Committee. Josh approached me about reading some material he had written for teaching high school statistics (non-AP). Josh had a dream that this material could be the beginning of a textbook where the context is primarily sports related and through the use of randomization tests and simulation, the four steps of the statistical investigative process can be carried out from the very first chapter of the book. The goal of the book would be to teach ALL students the principles of statistical reasoning in an accessible and fun manner. After reading the two chapters Josh had drafted and his outline, I enthusiastically encouraged Josh to write more. Freeman Publishing recognized the potential of this book for the high school curriculum and signed the book project. Josh then asked me if I would assist him with the book. I had no hesitancy in saying yes. This book was Josh's creation and he generously gave me the gift of sharing the journey of this book with him. Because of Josh, I was able to live my dream of a sports statistics book. The timing for the book was ideal in that the book supports the recommendations of the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Pre-K-12 and College Reports* and the book aligns with the statistics strand in the recently adopted (approximately 46 states) Common Core State Standards for Mathematics. I have to also mention that the *SRIS* book was part of an article ("At Moneyball U, Where are the Odds?" by Alan Schwarz) in the New York Times. The article, published in November 2011, focused on using sports contexts to teach statistics.

PreK-12 GAISE Report

AR: You mention the GAISE reports here, so let me use that as a segue for discussing your impact on PreK-12 statistics more broadly than your work with AP Statistics. You and Joan Garfield spearheaded the GAISE project, with you leading the PreK-12 aspect. Before we get into specifics, can you tell us how the GAISE project came to be?

CF: In January 2003, Joan and I were invited to participate in a National Research Council workshop, *Bridging the Gap Between Classroom and Large-Scale Assessment*, held at the National Academy of the Sciences in Washington DC. We were ASA's representatives. One evening, after attending the workshop all day, Joan and I were relaxing in the hotel lobby and began brainstorming about needs within the statistics education community. We first discussed how there should be a revisit and expansion of the excellent guidelines (*Heeding the Call for Change: Suggestions for Curricular Action)* that George Cobb recommended in 1992 for the college introductory course. This revisit was especially important given the advancements in technology that had resulted in the availability of graphing calculators, computers, and applets for teaching a more conceptual based course. Technology advancements also encouraged the use of more and larger real world data sets in teaching the introductory course. Given my interest in K-12, I spoke about how I felt the data analysis and probability strand in the 2000 NCTM *Principles and Standards for School Mathematics* should be expanded upon with a companion document that supported teachers, state level educators, and policymakers in understanding the intended interpretation of the NCTM statistics standards. I envisioned a document that would provide a 'big picture' and deeper understanding of statistical thinking (from designing studies and exploring data to inference) plus how statistical concepts evolve from early grades to high school. Now we who know Joan understand that once a seed is planted, she will nourish that seed and see that it grows. She immediately said to me that we *would* submit an ASA strategic initiative to fund the writing of these two documents. She would chair a college writing team and I would chair a Pre-K-12 writing team. Like Dick Scheaffer, I can't say no to Joan. ☺ We took this idea to the ASA Advisory Committee for Teacher Enhancement (ACTE) of which I was a member and the committee supported this proposal. Joan and I wrote the initiative and the ASA board with their vision supported the initiative. Jeff Witmer was key in coming up with the title, *Guidelines for Assessment and Instruction in Statistics Education* (GAISE). As an aside, I mentioned earlier that landing at University of Florida with Dick Scheaffer and other UFL colleagues was magical. Collaboration with Joan has also been a magical landing in my professional journey. She has a vision and energy that are contagious resulting in positive advancements for the field of statistics education. Joan is a pioneer leader and innovator in the field of statistics education who has the talent to recognize the strengths of others and gently encourages the use of that strength. She has been one of my biggest supporters and a close friend.

AR: It can be notoriously difficult for a group of academics to agree on much of anything, let alone as grand a goal as establishing guidelines for teaching statistics throughout the PreK-12 levels. How hard was it to bring your group to consensus, what were the stumbling blocks, and what were the keys to achieving what the group did?

CF: I was honored to work with an incredible group of dedicated writers for the *Pre-K-12 GAISE*

Framework: Gary Kader, Jerry Moreno, Roxy Peck, Mike Perry, Dick Scheaffer, and Denise Spangler. The first meeting of initial discussions for the PreK-12 GAISE was held in August 2003 at the Joint Statistical Meetings. The writing team realized at this meeting the enormous task ahead. We were proposing to create a document unique in its structure for standards at Pre-K-12. The second meeting was held at the conclusion of the ASA sponsored TEAMS conference, held at the University of Georgia in October 2003. The keynote speaker was Johnny Lott, then President of NCTM. In his presentation, Johnny asked the statisticians, "In NCTM's *PSSM,* the concept of the mean is discussed at the elementary, middle, and secondary levels. What is going on in statistics if you are doing the mean at all three levels? Are you doing the same thing?" The PreK-12 GAISE writing team received the first "light bulb" moment of how the PreK-12 GAISE document should be structured with three levels. However, the actual writing was challenging. We were starting from scratch with no previous model to follow. The strategic initiative budgeted for one meeting at ASA headquarters in January 2004. The team worked diligently at outlining the document and levels. At the end of the two days, we left with writing assignments. We attempted to rely on email correspondence. As time moved along, I came to understand that the team was at a crossroads – we were having trouble pulling together the writing for the three levels, the "framework" was not well defined and congealing, and the document was disjointed. No doubt, I was becoming a "pest" as I attempted to set deadlines for very busy individuals (this was a volunteer effort by the writers). We were not adequately moving forward relying upon email – we needed another face-to-face meeting that was not budgeted in the strategic initiative. Tom Short, chair of the ACTE committee at that time, came to our rescue. He understood the importance of this document and collaborated with me to arrange the annual ACTE meeting at the University of Georgia and to invite the GAISE writers as guests. It was at this meeting that the second major "light bulb" moment occurred and the two-dimensional Framework model emerged and became well defined (see pages 14-15 of document). From that point on, the writers were re-energized and the content for the three levels flowed. The marrying into one voice was the final challenge. There was numerous back and forth revisions. The ASA board endorsed the document in August 2005. Looking back, all the writers are both amazed we were able to produce the document in roughly a year and at the tremendous impact this document has played in promoting statistics at K-12. Without a doubt, the *PreK-12 GAISE Framework* is one of my most enriching and rewarding professional undertakings.

AR: Who did you have in mind as the intended audience for this GAISE document? How did you try to make that audience aware of the document? What feedback did you receive from this audience?

CF: The writers wanted developers of state and potentially national mathematics standards to take notice of this document. We also intended the document for faculty of teacher preparation programs, math curriculum directors, and K-12 teachers to assist in interpretation of the NCTM data analysis and probability strand. I personally experienced the importance of the *GAISE* document in my state of Georgia. In 2005 after the ASA board approved the *PreK-12 GAISE Framework,* Georgia was in the process of revising their state mathematics standards. It was about this time that the GA Department of Education released their draft standards for review. I was taken by surprise at what was being called the statistics and probability standards most especially at high school. Mathematical topics such as Venn diagrams, sequences, and series were part of the statistics standard. There was no mention of the statistical investigative process.

I was invited to speak to the advisory board and the timing was perfect to present the newly approved *GAISE Framework.* I asked the advisory board to reconsider the statistics standards. The advisory board of dedicated teachers and leaders embraced the *GAISE Framework* and asked that I advise the rewriting of the statistics standards. The resulting Georgia Performance Standards (GPS) had statistics as one of its major strands and GA became a leader for including statistics at K-12 – all because of *GAISE.* Interestingly when GA adopted the Common Core State Standards (CCSS) in math, the GPS contained more statistics than CCSS. Other *GAISE* writers worked within their states and nationally to promote the document and the inclusion of more statistics at the state level. ASA embraced this document most especially the Joint ASA-NCTM Committee and at that time, the ASA leader of K-16, Martha Aliaga. The Joint Committee worked with some of the authors to revisit the document for fine tuning and further bringing the document to one voice. The committee financed the publication of the document in printed form (not just pdf files at the ASA website). The printed copies came out in January 2007, in time for a national conference in Washington DC, *Center for Study of Mathematics Curriculum (CSMC) K-12 Mathematics: What Should Students Learn and When Should They Learn It?* Martha Aliaga, who passionately believed in this document, was visionary (along with the Joint Committee) in understanding the importance of presenting the *GAISE Framework* at the conference and made certain that printed copies of the document were available for all attendees – state educational math leaders and national math organization leaders. Gary Kader and I presented sessions on the document and the participants were enthusiastic about what they heard. I have always viewed this conference as a turning point for the future impact the *GAISE Framework* has made with the writing of some state standards, the College Board mathematics standards for grades 6-12, the Achieve mathematics standards, the redesign of curriculum at teacher preparation programs, assessment items for high stakes tests, and the recent Common Core Standards. Outstanding education leaders have often told me that the mathematics community needs a Pre-K-12 Framework like our document. What a high complement given all the wonderful documents in existence within the mathematics community for K-12.

AR: That's a great success story. I agree that the GAISE document has already had a very large and positive impact. The Common Core State Standards (CCSS) that you mention are about to be implemented. What's your sense of the CCSS with respect to statistics? And are you optimistic about how effectively statistical ideas will be taught (and, more importantly, learned) at the K-12 levels in upcoming years?

CF: Statistics has a strong presence in CCSS for grades 6-12. The Statistics standards emphasize conceptual understanding and present us with what I believe is a great opportunity of "statistical literacy for all." The CCSS were written with the goal of introducing basic statistical concepts at an intuitive level, as can be seen with the strong emphasis on simulation. Given that almost all of the states have adopted CCSS, the Statistics standards should finally be taught nationwide. Since a national assessment including statistics items will be required in the upcoming future, it should be a guarantee that Statistics will be included in the Math curriculum for grades 6-12. However, with this wonderful opportunity of "statistical literacy for all" comes the challenge of preparing K-12 teachers to deliver the statistical content in CCSS both at the pre-service and in-service level. The Conference Board of the Mathematical Sciences (CBMS) identified the statistical preparation of teachers as an area of concern in their recent publication of the Mathematics Education of Teachers 2 (MET2) document. Although advances have been made in recent years at select teacher-preparation programs (including here at the University of Georgia), the

inclusion of Statistics in the teacher preparation curriculum has not been a high priority. Most of our current K-12 teachers have either never taken a formal Statistics course or the statistical training they received occurred in the traditional formula-oriented courses. I am especially concerned about in-service teachers at grades 6-8. The writers of the CCSS made the decision to eliminate Statistics from the K-5 curriculum. The ASA and the writers of the PreK-12 GAISE Framework strongly advocated maintaining Statistics in the K-5 curriculum. However, as a result of the CCSS writers' decision, grades 6-8 are now packed with the students' first real exposure to Statistics. Thus, teachers in these grades are being asked to teach many unfamiliar statistical topics. This leads to the question, "How do we equip K-12 teachers with the necessary tools and knowledge in Statistics to help their students develop into competent consumers of statistical information?" This includes not only advancing teachers' content and the pedagogical knowledge needed in teaching the statistics content students are expected to learn, but also in preparing students with strategies for handling the statistical concepts that they will encounter in the future. So a short answer to your questions would be, yes, I continue to remain optimistic that statistical ideas will be effectively taught and learned in upcoming years. However, it will not happen overnight and it will have to become a priority of our teacher preparation schools, our K-12 schools, our state departments of education, our national educational organizations, and dedicated statisticians and statistics educators to all embrace statistics as a critical part of the mathematics curriculum.

Preparing Statistics Educators

AR: You mention that teacher preparation programs have not necessarily placed much emphasis on the field of statistics. What have you done at the University of Georgia in this regard? What do prospective teachers learn about statistics, and about teaching statistics? In what courses do they learn this?

CF: I have mentioned earlier in the interview about landing in magical places. The University of Georgia is another magical spot. Not only have I worked for 25 years in a supportive Statistics department but I also have been privileged to collaborate with one of the top ranked Mathematics Education programs in the nation. In the 1990's, both departments were visionary in understanding the role Statistics would play in the future of the K-12 mathematics curriculum. Discussions began in the mid 90's about how to strengthen the teacher preparation of students at UGA for the delivery of the Statistics content at K-12. In 1998, I began teaching the newly developed course, Probability and Statistics for Secondary Teachers. The course is taught in the Statistics department and carries the Statistics prefix. The course has been a tremendous success and is in its 16th year. The course is unique in how content and pedagogy are integrated. The course has two goals: to prepare teachers to understand and teach the Common Core State Standards in Statistics (in the past we focused on the GA state standards) and to understand using the data that drives the teaching profession (for example, data related to standardized tests). A wonderful description of the course can be found at the following link under the title, "Statistics for Teachers Class": www.stat.uga.edu/newsletter/index.php?q=program_updates. This course is the foundational course for the new Masters Program in Statistics Education being developed in the UGA Statistics department, under the leadership of my colleague, Jennifer Kaplan and in collaboration with the Mathematics Education department. We are very excited about the future of graduate degrees in statistics education at UGA.

Also, in the early 2000's, the Statistics department and Mathematics Education department developed collaboratively two more courses, one for middle school teachers and one for elementary teachers. I taught these courses off campus to in-service teachers who were working towards Master degrees in Math Education. Especially rewarding was teaching the course for elementary teachers. I team taught this course with Denise Spangler (one of the PreK-12 GAISE authors and Chair of the Math Ed department). We both learned so much from each other. It was after this gratifying endeavor of team teaching that I experienced one of my most rewarding professional development endeavors where I spent the academic year (2008-9) housed in the UGA mathematics education department working with and learning from the mathematics education faculty and graduate students.

AR: Let me ask a bit more about your new graduate program in statistics education at UGA. What kinds of students do you hope to attract to the program, and what career paths do you expect them to pursue after completing the program?

CF: For the Masters of Science in Statistics Education degree, we see the client audience as (1) certified high school mathematics teachers who wish to specialize in teaching statistics (2) undergraduate mathematics or statistics majors who wish to teach statistics at 2- and 4-year undergraduate institutions and (3) Ph.D. students in statistics who want a strong teaching credential underlying the doctorate degree. For the future Ph.D. in Statistics Education, we see the client audience as individuals who desire the higher education academic career path most especially at teacher preparation colleges and universities.

AR: What role do you see for statistics education research in UGA's graduate programs? Will preparing education researchers be a primary goal, in addition to preparing teachers of statistics?

CF: The M.S. in Statistics Education at UGA will have three components a student must complete: (1) The three core Statistics content courses required of students pursuing the traditional M.S. in Statistics, (2) the supervised consulting course and (3) two core statistics education courses, the content and pedagogy course I mentioned earlier and a second course in statistics education research (both courses taught by a statistics educator in the Statistics department). The students will then choose either the exam option (5 elective courses and a comprehensive exam) or the thesis option (3 exams and research in statistics education for a thesis). So in answer to your question, yes, preparing our students to be education researchers is a goal of the program as well as preparing our students to teach. It was during my year spent in the mathematics department that I came to realize how much statisticians can learn and build upon from math education research. Fortunately, our students will be taking at least one elective course in the mathematics education department, affording them the opportunity to work with our outstanding mathematics education faculty.

Pop Quiz

AR: Now we begin what I call the "pop quiz" portion of the interview, where I'll ask a series of very short questions that I'll encourage you to answer with very short responses. What are some of your hobbies outside of statistics education?

CF: I am a dedicated runner, grateful that I have my health to plod along. I also enjoy hiking. I have priceless memories of three 11-day backcountry treks with my two sons and other scouts in Philmont, NM. I am an avid reader. My favorite way to relax is at a baseball game keeping my personal scorebook. The photo with this interview was taken at the UGA Foley Baseball Field. My sons have been loyal through the years in attending baseball games (too many to count) with their mom and helping to keep my scorebooks up to date!

AR: You just mentioned your sons. Please tell us about your family.

CF: What an incredible, generous, and loving family who have been my biggest supporters in promoting the vision and goals of statistics education. My husband, Dale Green, is a physician. He is currently working as a Chief Medical Informatics Officer, supervising data analysts in the health care world. My oldest son Corey is completing a Master of Science degree in Forestry at UGA focusing on biometrics. How neat to watch two of my family members use statistics on a daily basis! My youngest son Cody is a first year student at UGA who is exploring his options for a major.

AR: Perhaps Cody will be using statistics soon also. Please tell us the names of a few books that you've read in the past year or two.

CF: Cody excelled at AP Statistics in high school. But he hasn't realized *yet* that he needs to take more statistics courses. ☺ My favorite book is *Angle of Repose* by Wallace Stegner. I often re-read the books written by Virginia Woolf. For light reading, I enjoy that suspenseful book that can't be put down. One of my favorite reads in the past year was *The Historian* by Elizabeth Kostova. By the way, before each fall semester, I always read *Goodbye, Mr. Chips* by James Hilton.

AR: Name some of your favorite places that you have travelled to. Perhaps you could include somewhere that you've been professionally, as well as a personal favorite or two.

CF: My overall favorite places would be the national parks in the United States – natural wonders in our backyard! My husband and I have taken memorable sailing trips in the British Virgin Islands. In 2011, my husband, two sons, and I spent a week in Piedras Negras, Mexico on a mission trip helping to build a house for a young family – we wish we could return but due to drug violence in the area, mission efforts are on hold. Professionally, two trips: (1) Attending ICOTS8 in Slovenia for a week with my two sons – what a beautiful country and one I would have not chosen to visit if not for the conference. We also spent 10 days in Greece on the Aegean Sea. (2) Spending a week in Medellin, Columbia, South America with my former Ph.D. student, Lucia Zapata working with her graduate students. Lucia recently translated the PreK-12 GAISE Framework into Spanish.

AR: Let me ask a series of questions on which I sometimes collect data from my students, which I'll now ask you: Would you call yourself an "early bird" or a "night owl"?

CF: An "early bird," although some friends claim I never sleep.

AR: Do you use a Mac or PC?

CF: Mac – I have been an Apple devotee since the first Apple computer.

AR: On what day of the week were you born? (You can use www.timeanddate.com to produce a calendar for your birth year.)

CF: Wednesday

AR: How many Harry Potter *books have you read?*

CF: Seven

AR: How many miles do you live today from where you were born? (You can use www.distancefromto.net to calculate this distance.)

CF: 165 miles

AR: Here's another question on which I collect data from students, a fanciful one: Suppose that time travel were possible, and you could take one trip. You can only observe, not change anything, when you get there. Would you travel to a time in the past or in the future? (Go ahead and explain your answer for this one.)

CF: A time in the future. As a mom, I would enjoy a sneak preview of where my sons are in their lives 10 years from now (at the future ages of 28 and 36). Professionally, in 10 years, where will Common Core and the teaching of Statistics be at the K-12 level?

AR: Here's another fanciful question. If I could offer you dinner for four to discuss statistics education all evening, who would you choose for your dinner companions, and where would you choose to have the dinner?

CF: I would choose individuals who I have never spoken to in person but who I believe could have a tremendous influence on promoting the importance of statistics in our world and the role of statistics education. President Obama who is intelligent, values education, understands the role of data as it relates to changing outcomes (like elections); however, I am concerned he is unaware of the importance of teaching statistics at K-12. Jimmy Carter and his potential for using statistics to help humanity. And as my third guest, a master K-12 teacher who has been instrumental in turning around what has been identified as a failing school or school system. Where to have the dinner? On my family farm in rural western NC experiencing my mom's cooking.

AR: That would be quite a foursome, and I'm sure that dinner would be delicious. Returning to a question that is more rooted in everyday life, what is your favorite course to teach?

CF: All of my courses are favorites in different ways. I most often teach the honors sections of our first two introductory courses that are writing intensive and include team projects. The students are motivated and challenge me to create a stimulating environment. You can read about our second honors course at the following link:
http://www.franklin.uga.edu/news/newsletters/statistics/2013/program_updates.php
I have a special fondness for the courses I developed and teach for K-12 teachers. These courses help to support the critical need for K-12 teacher preparation in statistics. Our K-12 teachers are key to disseminating the belief that statistical literacy is essential for all students and citizens.

Parting Thoughts

AR: The theme of the USCOTS conference held in 2011 was "The Next Big Thing." What do you think the next big thing in statistics education is?

CF: My hope is that all teacher preparation programs will recognize and prioritize the critical need for more statistics in their K-12 program of study. And that there are statistics courses developed just for teachers – the necessary statistical knowledge for teachers is not necessarily the same as for the general student. I am fortunate to be part of an ASA writing team who will be writing a companion document (The Statistical Education of Teachers) to the Mathematical Education of Teachers 2 (MET2) document. As the need for more statistics training in teacher preparation comes to fruition, there will be a demand for statistics educators at our colleges and universities. My dream is to watch UGA set the groundwork for statistics departments incorporating graduate degrees in statistics education as part of their core mission.

AR: You can probably anticipate my next question. The theme of the 2013 USCOTS conference, at which you gave one of the introductory 5-minute talks and then received the Lifetime Achievement Award, was "Making Change Happen." How has change played a role in your career? What thoughts do you have about how statistics educators can make change happen?

CF: The title of my 5-minute talk was "A Personal Journey with my Heroes – Igniting Change in K-12 Education." By the way, this was one of the most challenging talks I have prepared and presented. ☺ I gave three principles that have guided my professional career: Follow your dreams, embrace risks and the detours along the way, and unexpected landings are often magical. Hopefully the previous comments in the interview explain how these principles have defined my career. How to make change happen? Any change that I have helped bring about is because of the magical places I have landed and the heroes I have collaborated with – many are mentioned in the interview. These individuals are leaders who have embraced change and inspired those around them to make change happen. They helped me to understand change is a team effort and more often than not a slow process. Staying the course is vital. The USCOTS lifetime award was a complete surprise (even my family knew weeks ahead of time). I am eternally grateful to the statistics education community for this most special honor. The four previous lifetime award winners are heroes who have truly made change happen in statistics education.

AR: As we wrap up this interview, here is a two-part question: Among all of your accomplishments in statistics education, which one are you most proud of? And, despite receiving a lifetime achievement award, I know that your career is by no means over. What's your primary professional goal that you aim to achieve before retirement?

CF: I am most proud of the personal accomplishments and callings my former students discover and how they often communicate with me about the positive role statistics has played in their lives. I smile observing they have become the advocates for the importance of statistics education. I must also mention I am proud of my involvement in the K-16 writing projects (the Pre-K-12 GAISE Framework and the before mentioned textbooks) that were team efforts to influence change for the better. For the future? I confess my energy level is slowing down. I have enjoyed every aspect of my professional career to this point but want to concentrate primarily on continuing efforts toward making statistics a stable part of the K-12 curriculum by influencing state and national policymaking. I also want to continue helping K-12 teachers feel confident in teaching statistics and contribute toward writing more resources for K-12 teacher preparation. The teacher preparation piece also includes contributing toward the success of the UGA graduate program in statistics education. Oh my, it now sounds like it may be a bit before I can completely retire.

AR: Thanks very much for answering all of my questions so thoughtfully, and for all of your contributions to statistics education and statistics educators. My final question is: What advice do you have for JSE readers, particularly those who are fairly new to statistics education?

CF: Allow yourself to become involved in the education community at the local, state, and national levels. I continue to be inspired by the dedicated educators I have met and worked with through the years at each of these levels. So many educators are seeking assistance with the statistics component of K-16 education and they sincerely value and appreciate the time and effort given by statistics experts. Volunteering in your local schools is much appreciated and rewarding. Consider offering mentorship or facilitating a learning community in statistics for teachers. I was fortunate to have the opportunity to serve for 10 years on my local school board. I was afforded a first-hand view of the daily operation of a school system, the needs of our teachers, and most rewarding, the many friendships and collaborations I was able to build with teachers and administrators to promote statistics education in our schools. It was through my role as chair of the board that a gateway was provided to connect with the state department of education. If you are in an academic college setting, build collaborations with colleagues in mathematics, mathematics education, and science education. At the national level, if not already, become involved with the ASA Section on Statistics Education. This section is a vibrant and welcoming community of statistics educators who are passionate about the work needed to promote the statistics education field. Everyone supports each other in this community and lasting friendships are formed. Apply and attend an AP Statistics reading and/or a statistics education conference such as the U.S. Conference on Teaching Statistics (USCOTS). I promise you will want to return year after year. My statistics education colleagues and friends keep me motivated and zealous about the importance of statistics education in our society and my students benefit from this comradely. Statistics education needs you!

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