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# Charlotte L. Haley

## Teaching Experience and Advising

### Teaching

Fall 2011 **MTHE 224 Course Instructor**, *Queen's University*,
Primary instruction and curriculum development for a 13-week second year engineering mathematics course. Course material included ordinary differential equations and introductory statistics with tutorials and laboratory work in Matlab.

### Advising

2016-2017 **Chris Geoga**, *B.Sc. Math & Stats, University of Chicago*, Predoctoral Appointee, Argonne National Lab, (i) Large-scale multitaper spectrum analysis implementation in Julia (ii) Detection & estimation of interarea oscillations in power networks (iii) Higher dimensional spectrum analysis..
Also advised by Mihai Anitescu

Summer 2014 **Paul Wilson**, *B.Sc. Math & Stats, Queen's University*, NSERC USRA, Project: Spectrum analysis of Solar Data.
Primarily advised by David J. Thomson

Summer 2013 **Julian Fortin**, *B.Eng. (Apple Math) Queen's University*, National Science and Engineering Research Council of Canada (NSERC) Undergraduate Summer Research Assistant (USRA), Project: Spectrum analysis of Proton Density at ACE.
Primarily advised by David J. Thomson

## Teaching Statement

Undergraduate teaching in statistics gives educators the opportunity to convey the quantitative backbone of the scientific method and to enable students to build skills in rational thinking and quantitative decision making. The importance of statistical literacy, in an age where the media manipulates statistical information, cannot be overstated. I am seeking a career in statistics education and research because I want to help communicate the thoughtful use of statistics as an analytic tool in STEM fields.

I have seven years of teaching statistics, tutoring, and advising students. I was the primary instructor for a second year undergraduate statistics course in the Civil Engineering department at Queen's University (Fall 2011). This course had over one hundred students, and I developed the course curriculum, lectured, and managed labs and tutorials. This course also had a

significant Matlab programming component in which labs and tutorials were led by my teaching assistants. I also managed tutorials, namely Differential Equations (2009) and Calculus (2014) which involved reviewing course material and helping students solve example problems. I also have over six years of private tutoring, student help desk tutoring, and statistical consulting experience with students from other disciplines.

My teaching philosophy is fundamentally based on conveying my enthusiasm for statistics using real data examples. I find that not only do hypothesis tests posed with real data yield interesting and meaningful results, they can be used to tell inspiring stories of scientific discovery. I believe in using a judicious blend of time-tested teaching methods and newer technology driven techniques (web-aided techniques) to impart quality education to my students. I enable my students to better assimilate my lectures by making my lecture notes available online and by posting high-quality project reports and code from my students to motivate and inspire the entire class. In courses that have a laboratory component, I present my lectures so as to provide a cohesive lab-lecture narrative. I have found that students find me approachable, often talking to me before or after class to provide me with comments and feedback and asking questions about course material.

My teaching style is engaging and interactive, with relevant short stories, anecdotes, videos, and student exercises woven in. For example, one of my very favorite elementary concepts to teach is the simple one-way ANOVA, mainly because it incorporates all of the basic concepts from a second year statistics course. Beginning with a very simple example, like salary data for new-hires just out of university grouped by faculty, say engineering, sciences and arts I'd start by reviewing the hypotheses (all means are equal), checking for normality and variance homogeneity of the sample, completing the ANOVA table, testing against the F-statistic thresholds and analyzing the results. The beauty of ANOVA is that it has a different interpretation in terms of linear regression. By revisiting the ANOVA table on the same example, showing that the model coefficients give the differences in means away from the reference group's intercept, and that the p-values for the regression give us more information about which population mean differs significantly from the others, we can really cement the students' understanding of the subject. I believe it is really simple to lose one's audience while making the very important connection between ANOVA and linear regression, but that by using a compelling example relevant to students' interests, using real-world data, and by carefully approaching the same problem in two different ways, one can both entertain and empower students to realize the value of statistics in their everyday lives.

I believe that undergraduate statistics education comes with challenges unique to the discipline. For students from other fields, such as medicine and psychology, the mathematical prerequisites and computational aspects of this field can be daunting. As an instructor, it is important to carefully review prerequisite material during lectures, make online supplementary resources and exercises available, be available for office hours, and make sure that students are aware of resources like the math help desk. It is also appropriate to tailor the examples to the students' interests. My goals in teaching statistics to students from other disciplines are to (i) promote statistical literacy (ii) foster enthusiasm for quantitative decision making and solid foundations of scientific methods (iii) communicate fundamental statistical concepts like

probability theory and hypothesis testing. For these students, it is useful to introduce them to computer packages like R, Minitab, and SPSS, but in such a way that it is engaging and fully integrated into classroom work.

I have also had the opportunity to supervise and mentor at Argonne National Laboratory and Queen's University. These collaborations have been very rewarding and have enabled me to practice the pedagogy of advanced research with graduate students. Most recently I have been advising a predoctoral appointee from University of Chicago. The goal is to implement a package for multitaper spectrum analysis in the Julia programming language, and to apply these techniques to power grid time series in order to detect network faults and system oscillations. In order to foster a congenial collaborative working environment, I have a flexible schedule where we meet every day to discuss results and possible new directions for research. In order to strengthen my students' background in the subject area, I suggest research papers and relevant study aids. I also use productivity software from Atlassian (git, Confluence) so that my students can give frequent updates on his or her work, we can track our progress, and that I can provide immediate feedback. As the seminar coordinator in the laboratory for advanced numerical simulation, I organize a yearly research symposium, not just for my students, but for all 20 summer students in the group, so that they can showcase their research achievements.

In am strongly committed to encouraging women and minorities in STEM fields. During my time as a graduate student at Queen's University, I was one of the primary organizers of a math camp named Math Quest (2012-2013). This program was aimed at inspiring high school girls 14-18 years old to take up careers in mathematics. To better enable the participants to explore mathematics-themed career possibilities, I gave a series of presentations and a radio interview. The presentations included topics on the mathematics of electrocardiograms and digital signals, financial mathematics, and the Monty Hall problem. Math Quest is in its fifth year of operation now, and has secured funding for the next five years.

Finally, because I am committed to my research, I aspire to teach advanced subjects close to my areas of interest. Specifically, I would be happy to offer an advanced time series course complete with both modeling and nonparametric frequency-domain analysis, as well as a course in spatial statistics. These courses would likely be of interest to statisticians, electrical engineers, and those interested in climatology, physics, and atmospheric science. I would also like to engage seniors in class projects that would train them to critically analyze research problems.