

Development of STA130

by Jeffrey S. Rosenthal, University of Toronto, June 2016

For the Winter 2016 semester, I developed and taught the brand new funded (and rather complicated) course, **STA 130H: An Introduction to Statistical Reasoning and Data Science**.

I was instructed that this course was supposed to accomplish numerous goals all at once, including:

- **INTRODUCTION:** A general introduction to the field of statistics.
- **RECRUITMENT:** A demonstration of the importance of statistics in fundamental scientific and technological progress, with an eye towards convincing strong students to study more statistics.
- **SOFTWARE:** Teach students to use statistical software (e.g. “R”).
- **ORAL COMMUNICATION:** Teach statistics students to express their statistical ideas well in spoken English, to help them actively participate in class discussions, ask questions in class, etc.
- **WRITTEN COMMUNICATION:** Teach statistics students to express their statistical ideas well in written English, to help them write reports, clearly explain their solutions on homework assignments, etc.
- **INTERNATIONAL:** Help international students to function well at U of T.
- **MENTORING:** Help students adjust to being university students, taking better advantage of university resources, participating more in university activities, meeting other statistics students, etc.

This was a very challenging list of goals to achieve. However, through hard work and extensive planning, I believe that I rose to the challenge and was successful, as follows.

Initial planning for this course included various meetings within the department, in the Dean’s office, with writing instructors, with mentoring program coordinators, and with other course instructors, as well as numerous e-mails and discussions to define the scope of the course.

I then had to hire five new TAs, from various departments, to play an im-

portant an active role in the course. To ensure high-quality TAs, I conducted all of the TA job interviews myself.

Then, over the course of the semester, I developed a total of 186 slides worth of brand new material to present in lecture; see <http://probability.ca/sta130-16/lecturenotes/>

I also developed lots of other materials for the class, including:

- Group activities for each week’s tutorial session, to encourage the students to work together orally; see e.g.

<http://probability.ca/sta130-16/grppval.pdf>,
<http://probability.ca/sta130-16/grpmeanvar.pdf>,
<http://probability.ca/sta130-16/grpmarg.pdf>,
<http://probability.ca/sta130-16/grpexpl.pdf>,
<http://probability.ca/sta130-16/grpspecies.pdf>,
<http://probability.ca/sta130-16/grpcompcor.pdf>,
<http://probability.ca/sta130-16/grpdrown.pdf>, and
<http://probability.ca/sta130-16/grpcornews.pdf>.

- Quizzes for each week’s tutorial session, many with a writing component, to help the students learn to express statistical ideas in written form; see e.g.

<http://probability.ca/sta130-16/quizpval.pdf>,
<http://probability.ca/sta130-16/quizmeanvar.pdf>,
<http://probability.ca/sta130-16/quizmarg.pdf>,
<http://probability.ca/sta130-16/quizgendata.pdf>,
<http://probability.ca/sta130-16/quizshoecomp.pdf>, and
<http://probability.ca/sta130-16/quizny.pdf>.

- A number of homework assignments to be completed using “R”, to help the students learn statistical software, and practice their statistical analysis techniques, and further improve their writing skills; see e.g.

<http://probability.ca/sta130-16/hwmarital.pdf> and
<http://probability.ca/sta130-16/hwhomicide.pdf>.

- An in-depth “professional report” data-analysis assignment, which provided individualised data to each student, and required them to perform a number of statistical analyses of their choosing, and write a detailed extensive report about their conclusions; see

<http://probability.ca/sta130-16/profreport.pdf>.

- A “professional presentation” assignment, <http://probability.ca/sta130-16/profpresent.pdf>, which required each student to prepare and give a brief presentation in tutorial about the main findings from their professional report assignment.
- A group discussion exercise, <http://probability.ca/sta130-16/grpprof.pdf>, designed to help the students prepare for their report and presentation.
- A midterm test (<http://probability.ca/sta130-16/midterm.pdf> / <http://probability.ca/sta130-16/midtermsol.pdf>) and final exam (<http://probability.ca/sta130-16/exam.pdf>) which required students to perform various statistical computations and analysis, and also to write about statistical ideas and conclusions in clear English.
- Extra practice problems (as requested by the students) for analysing real data in the news, e.g. <http://probability.ca/sta130-16/compareUPX.pdf> and <http://probability.ca/sta130-16/pracprov.pdf>.

I worked throughout to connect the lecture material as much as possible to specific data applications and current news stories, such as:

- Public opinion polls about the new Trudeau government, attitudes towards the legalisation of marijuana and to Syrian refugees, public trust in Toronto police, happiness levels, and the February 11 Whitby-Oshawa provincial by-election.
- Medical studies about flu vaccine, and drug testing, and the relationship between marriage and mortality.
- Crime studies comparing homicide rates in major Canadian cities.
- Comparison of weights and offspring of different animals, and babies being girls or boys, and smoking status versus wealth and education and baby weights, and sports statistics about hockey and basketball.
- Testing if a coin is fair or two-headed, and whether a subject has ESP powers to guess cards, and whether a casino’s dice and roulette wheels are fair or crooked.
- Relationships between temperature and cricket chirps, and SAT scores, and baby twins, and the influence of socioeconomic covariates on recent voting patterns for Donald Trump, and more.

I also had my TAs share with the students their own stories of data analysis arising in such diverse subjects as Psychology, Epidemiology, Anthropology, and Statistical Genetics.

In a separate direction, the students were required to participate in two activities which were external to the course itself:

- Attend at least two university student participation activities, to better acquaint themselves with all that the university has to offer, and get them into the habit of actively participating in university events.
- Attend at least three discussion sessions with an upper-year statistics undergraduate student “mentor”, to receive advice and counselling regarding how to succeed in their studies.

Student participation in these two external items was recorded by the event leaders, as coordinated by Gillis Aning, and contributed a little bit to their STA130 grade.

Overall, I believe that the course was successful in introducing the students to the basics of statistical reasoning and data analysis together with such important skills as statistical software, report writing, oral discussions, scientific presentations, and more.

For further details about the course, see:

<http://probability.ca/sta130-16/>

See also this article:

<https://www.artsci.utoronto.ca/news/statistics-course-incorporates-oral-and-written-communications-skills>