

# Teaching an Introductory Statistics Course: Challenges and Strategies

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# Let's Look at Some Data

- Non-politics introductory statistics courses in social sciences:
  - 5 year average: 2008/09–2013/14
  - ECO 302, PSY 251, SOC 301, WWS 200, WWS 332

	Lectures	Assignments	Readings	Precepts	Overall
Statistics	3.2	3.3	3.1	3.6	3.1
All PU courses	3.8	3.7	3.7	4.0	3.9

- Politics introductory statistics courses (last time taught by us):

	Lectures	Assignments	Readings	Precepts	Overall
POL 345 (2011)	4.0	3.8	3.7	4.2	4.1
POL 245 (2014)	4.4	3.9	3.5	3.9	4.3

# Why Teaching Introductory Statistics Courses is Hard

## 1 Students are **not interested in statistics**:

	Professor	Distribution Requirement	Departmental	Certificate Program	General Interest
Statistics	0%	20%	71%	3%	6%
All PU courses	6%	12%	32%	7%	42%

*“Professor Imai tried hard to make statistics interesting. But, statistics is boring.”*

## 2 Students have **weak mathematical and programming background**

*“as a person not naturally inclined towards statistics and probability, I don't feel at all qualified to pass judgement on how the course might have been improved.”*

# Two Strategies

## ① **Motivating** students

- Statistics as a necessary tool for modern social science research
  - Junior papers and senior thesis
  - Reanalysis of data from published research
- Statistics as a useful skill for post-graduate career
  - Stories from course alumni/alumnus in various industries
  - Use of real-world examples

## ② **Helping** students learn

- Short but frequent assignments
  - Pre-precept assignments
  - Problem sets, quizzes
- Hands-on instruction in computer labs
  - Detailed handouts
  - Practice questions
- Outside-of-classroom assistance
  - Extra office hours, McGraw study halls
  - Piazza online discussion board

# POL 245: Visualizing Data

- A new course offered first in Summer 2013
- Instructor: Jonathan Olmsted, Course head: Kosuke Imai
- Supported by the 250th Anniversary Fund
- Key idea: Teach **data analysis** *before* statistics
- POL 345 teaches both statistical concepts and data analysis skills
- This is too much for some students
- Take the first half of POL 345 and expand it into a full course
  - analyze a variety of structured and unstructured data
  - show data analysis and statistics are **fun** and **relevant**
- Challenge: Can we teach this course well so that students are encouraged to take the next statistics course?

# Freshman Scholars Institute

- 6-week long summer school for a subset of incoming freshman
- an incubator for new courses
- Enrollment: 30 students
  - come from “disadvantaged” background
  - the first to go to college in their family
  - lack mathematical and computing background
- Goals:
  - transition them from high school to college
  - get them used to Princeton before the semester starts
  - offer head start by earning early PU course credits
- Similar programs at other schools: <http://nyti.ms/1gjJ0oU>
- A hard test for our teaching strategies

# Overview of POL 245

- **Modules contents:**

- ① Identifying causal effects (racial discrimination)
- ② Discovering patterns (political polarization)
- ③ Making predictions (election forecasting)
- ④ Textual data (federalist papers)
- ⑤ Network data (supreme court citation)
- ⑥ Geospatial data (Walmart expansion)

- **Module format:**

- ① Two 50 minute lectures
- ② Two 80 minute lab sessions
- ③ One 80 minute guest lecture from industry, discussion over lunch (NYT, Facebook, Political and Energy consulting firms)

- **Assignments:**

- ① Four problem sets with no collaboration
- ② Six short non-graded pre-lab assignments
- ③ One take-home midterm
- ④ One collaborative final project and group presentation

# Results and Next Steps

- Some encouraging feedback:

*“The course was a lot of fun and really interesting and I plan on taking the next level of the course.”*

*“I really enjoyed this course, and that is why I want to take POL 345.”*

*“I felt it gave me a very true sense of what to expect at Princeton.”*

- Next steps:
  - ① Write a book to improve the course and impact beyond Princeton
  - ② Completely flip the course
  - ③ Offer the course during the regular semester
  - ④ Develop a curriculum for a sequence of statistics and machine learning courses as part of the certificate program