

# Introductory Statistics for 10's of Thousands of Students from Dozens of Countries in One Lecture Section (and a few hundred at home)

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May 18, 2013



## Massive Open Online Course

*My current thinking about MOOCS is that they are:*

- A. a possible threat.*
- B. a fun diversion for those looking for one.*
- C. possibly useful for some limited purposes.*
- D. the beginnings of a massive transformation of post-secondary education.*



# "Making Change Happen" ... quickly

End of 2011

- ★ Andrew Ng's free online offering of AI course to >100,000 students.

- ★ *"Interesting ..."*

July 2012

- ★ New version of our introductory statistics course for new program.

- ★ Plan for Fall 2013: flip classroom.

- ★ University of Toronto partners with Coursera.

- ★ *"I'll have to think about this when I have time ..."*

September 2012

- ★ Bill & Melinda Gates Foundation RFP.

- ★ *"Do I really want to do this?"*

April 2013

- ★ *Statistics: Making Sense of Data* is live on Coursera.



# The Teaching Team

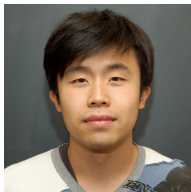
Co-taught by me and Jeffrey Rosenthal



# The Teaching Team: It takes a village...



Cristina



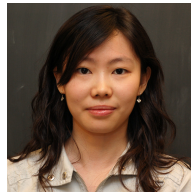
Edwin



Emery



Jana



Jinyoung

[Acknowledgements page](#)



# The interests of the Gates Foundation

*Some snippets from the RFP:*

- ▶ Courses that are aligned with a typical course offered at most colleges and universities for a high-enrolment, low-success introductory level course that is a barrier for success.
- ▶ Broader range of learners than is currently served by MOOCs.
- ▶ MOOCs may provide institutions a way to blend MOOC content into formal courses . . . and also provide students an alternative and direct path to credit and credentials.
- ▶ Want to learn:
  - ▶ for which students, disciplines, and contexts MOOCs are more and less effective,
  - ▶ what additional supports need to be added,
  - ▶ what data is most informative for advancement of learning.



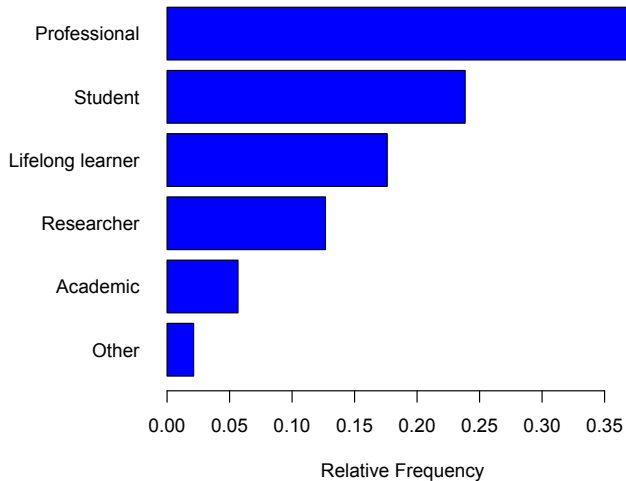
# Our students

50,812 students registered in the course (as of Tuesday May 14 at 10 pm EDT).

17,539 completed the pre-course survey.

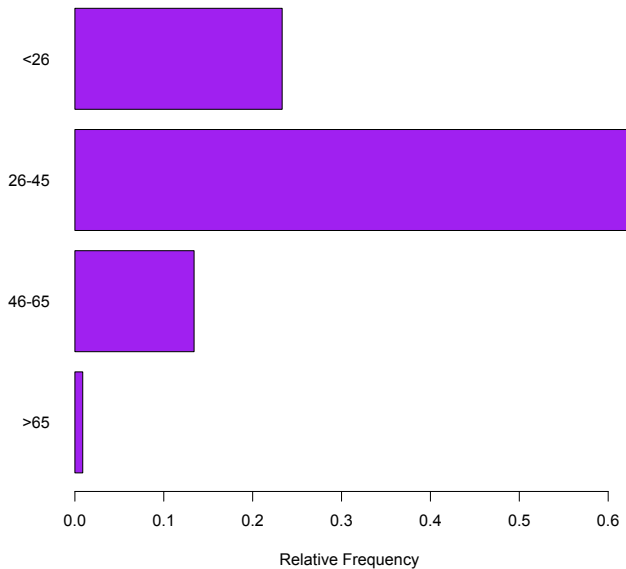


# Our students

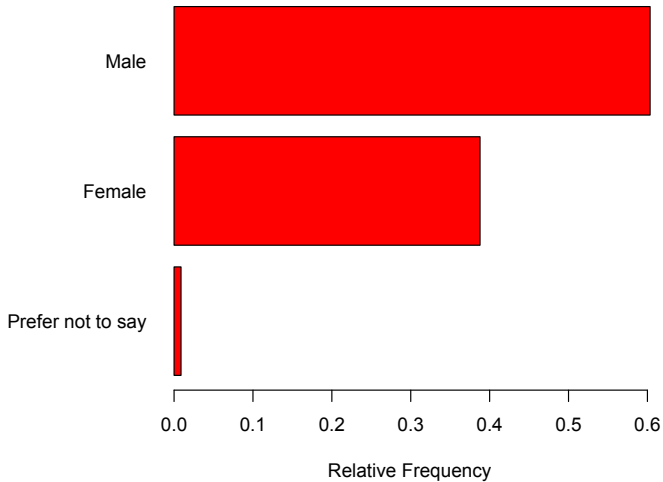




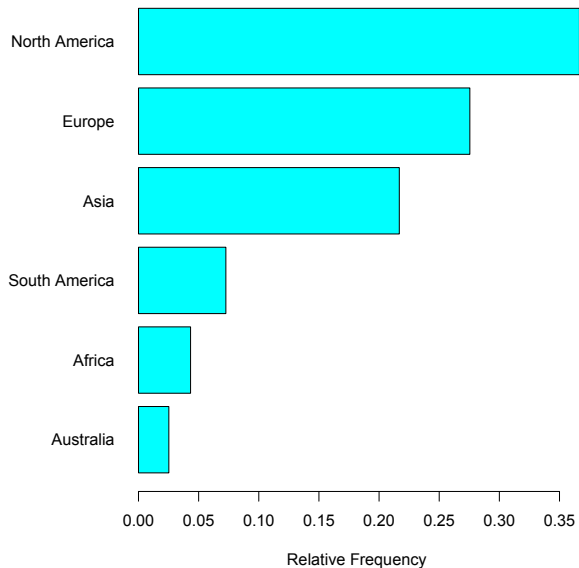
# Our students: age



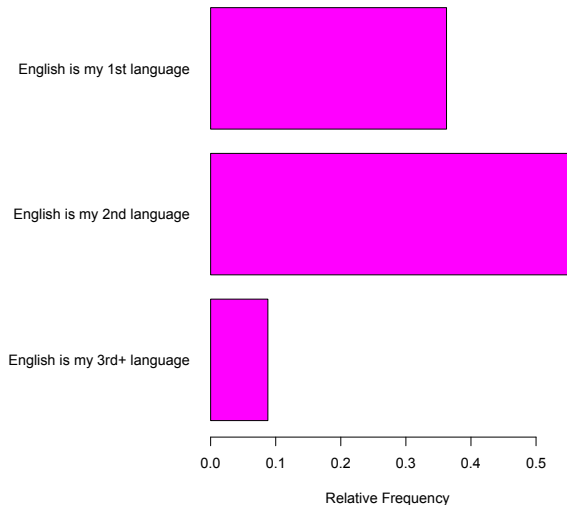
# Our students: sex



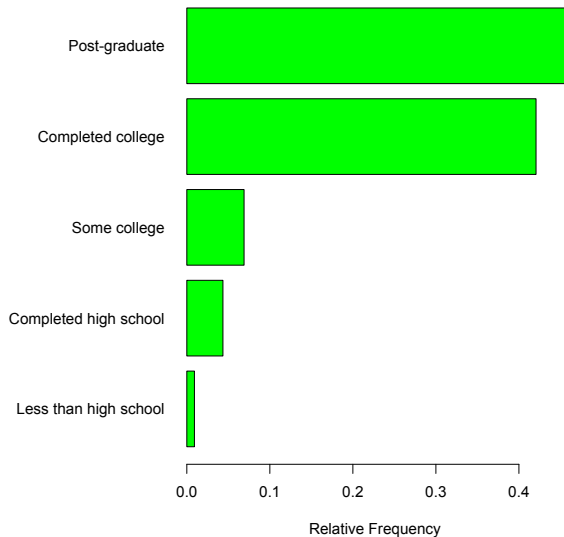
# Our students: region of the world



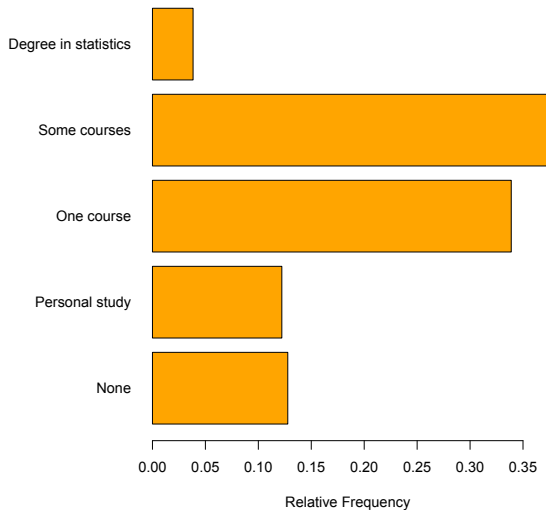
# Our students: English language usage



# Our students: level of education



# Our students: statistics background



# Our philosophy

- ▶ Start with rich data
- ▶ Try to keep lectures dynamic
- ▶ Make the content flexible and not too specific
- ▶ No barriers to earning a Statement of Accomplishment for anyone who does the work
- ▶ Maintain a sense of humour
- ▶ *Priorities:*
  1. Plan the syllabus
  2. Choose the data
  3. Complete the lectures
  4. Start to work on incorporating adaptive learning and customized Java applets and authentic evaluation.



1. Compress the course into 8 weeks
2. Don't require a statistical software package
  - ▶ Provide optional R tutorials
3. Weekly quiz
  - ▶ 10 multiple choice questions
  - ▶ Randomly generated
  - ▶ Students can take up to 100 times
4. Two peer-assessed assignments
  - ▶ Written interpretations of the results of a data analysis
  - ▶ Full marks for people who complete assignment plus 5 peer evaluations
5. To earn a Statement of Accomplishment: 81%





# The Syllabus

## **A first look at data**

Weeks 1-2: Summary statistics and graphical displays for a single categorical or quantitative variable and for relationships between two variables

## **Collecting data**

Week 2: Sampling. Observational studies and experiments. The effect of confounding and concluding causation.

## **Probability**

Week 3: Probability models, the normal distribution, the Law of Large Numbers, the Central Limit Theorem, sampling distributions.

## **Confidence Intervals**

Week 4: Confidence intervals and sample size estimation for proportions and means.

## **Tests of significance**

Week 5: Tests of significance, power and sample size estimation for proportions and means

## **Two samples**

Week 6: Tests of significance and confidence intervals for proportions and means in the two sample case.

## **Simple linear regression**

Week 7: Method of least squares, evaluating model fit, the effects of outliers and influential observations.

## **The process of statistical inquiry**

Week 8: Capstone case study.



# Planning Video Content

- ▶ One concept, one video.
- ▶ Coursera recommends videos should be 8-12 minutes long
- ▶ Breaking it into bite size chunks ...
- ▶ An example: Week 5: Statistical Tests of Significance
  - ▶ 5.1 Introduction to Statistical Tests (7:37)
  - ▶ 5.2 The Structure of Statistical Tests (11:42)
  - ▶ 5.3 Hypothesis Testing for Proportions (8:05)
  - ▶ 5.4 Hypothesis Testing for Means (10:21)
  - ▶ 5.5 Power and Type I and Type II Errors (19:44)
  - ▶ 5.6 Some General Advice About Statistical Tests (13:11)
- ▶ Our longest video: 3.5 Sampling Distributions (25:26)





## Lecture 4.1 Introduction to Confidence Intervals

Key feature: embedded quizzes



# A tour of Coursera

- ▶ Introduction to the class
- ▶ Course home page
- ▶ Videos
- ▶ Quizzes
- ▶ Assignments
- ▶ Reminders:
  - ▶ Weekly announcement
  - ▶ To Do list
  - ▶ Course dates
- ▶ Wiki



# The Forums: The friendly discussion

Forums / Questions on Lectures / Week 2

## Morbid preoccupation with death and disease

Subscribe for email updates.



Sort replies by: [Oldest first](#) [Newest first](#) [Most popular](#)

No tags yet. [+ Add Tag](#)

· a month ago



Have you already made all the videos? If not, could you by any chance lighten up the choice of variables? Estimating age of death, comparing life expectancies, survival rates of smokers, rates of viruses that cause genital warts and cervical cancer. My lord! And I'm only through the second video. Who knows what kinds of unpleasanties you will be using in future videos as a vehicle for teaching us! Are statistics not used for less tragic and macabre things? How about more of comparing helmet use and sex?

Other than that, love the quality of the videos! :)

If this post is out of line or irrelevant, please feel free to delete it.

0 · flag

# The Forums: The support team

██████████ · 21 days ago 



Gosh suddenly its all greek and latin to me..im dreading i wont be able to finish this course:(

↑ 2 ↓ · flag

[+ Comment](#)

██████████ · 21 days ago 



Take it from someone equally lost :) this week (#3) will need a few viewings. Having taken the quiz and not been terribly successful, i took a break and did the Assignment. Now I'm going to get back into it again. But I think a break is a good idea. Give your brain time to relax and repeat it. Some stuff will have stuck, it just needs to get reinforced.

The fact that this was a theory heavy week makes it more difficult as I don't remember any of the theory at from my school days so i'm having to learn a lot in a short period of time.

Don't panic, don't give up.

- Watch the videos and take notes,
- Do the quiz after finishing the videos and refer to you notes,
- If the quiz does not go well then take a break (I took a day) and
- Then repeat the process.

You'll get there.

That's my plan anyway :)

# The Forums: The critics

Forums / General Discussion

## Great Course But...

Subscribe for email updates.



Sort replies by: [Oldest first](#) [Newest first](#) [Most popular](#)

No tags yet. [+ Add Tag](#)

 · a month ago 



Great course, fantastic material. However I feel Alison delivers the content faster than the brain can grasp when grappling with new concepts. This might well be my brain is manifesting the symptoms of a slow-learner or a pervasive general sense of a substantial portion of the student population of this course.

If my sense is not that of an outlier (sorry being corny and I also understand video pause and/or revisiting the video are workarounds) I would like to suggest slowing down a tad could add to the tutorial efficacy.

 **32**  · [flag](#)

 · a month ago 



45000 candidates and everybody has its grasping potential. Your claim is without statistics.:).

 **-6**  · [flag](#)



# The Forums: The crank

Anonymous · a month ago 



The lecturers speak as if they are on psychoactive medication, creating an impression somewhere between a plastic smile and outright condescension. It is painful to listen to these lectures.

↑ -70 ↓ · flag

*How many students have we had to ban from the forums?*

*A. 0*

*B. less than 5*

*C. 5-10*

*D. more than 10*





# The “Harsh Realities”: Workload

- ▶ “Equivalent to teaching a full course plus 40 hours / week of TAs.”
- ▶ Survey in *The Chronicle of Higher Education*:
  - ▶ Median number of hours spent preparing for a MOOC: 100.
  - ▶ Median number of hours spent per week on a MOOC while it is in session: 8.
- ▶ Duke’s 1st MOOC: Over 600 hours of effort were required to build and deliver the course.
- ▶ A UofT colleague: “I had almost no time for anything else . . . It’s equivalent to volunteering to supply a textbook for free and to provide one chapter of camera-ready copy every week without fail.”
- ▶ We spent more than this.

*On average, how much production time is required for every minute of video?*

A. 2 minutes    B. 10 minutes    C. 30 minutes    D. 1 hour



# The “Harsh Realities”: Workload

50,812 students registered in the course, as of Tuesday May 14 at 10 pm EDT

*On average, how many e-mails per week do Jeff and I receive?*

- A.  $> 100$
- B.  $50 - 100$
- C.  $10 - 50$
- D.  $< 10$



# The “Harsh Realities”: Participation

*How many registered students have done something (watched a lecture, posted on the forums, tried a quiz, ...)?*

- A. > 45,000
- B. 40,000 – 45,000
- C. 35,000 – 40,000
- D. < 35,000

*How many students registered in the last week (week 6 of an 8 week course)?*

- A. > 1000
- B. 100 – 1,000
- C. 1 – 100
- D. none



# The “Harsh Realities”: Participation

*How many people submitted at least one quiz?*

- A.  $> 25,000$
- B.  $20,000 - 25,000$
- C.  $15,000 - 20,000$
- D.  $< 15,000$

*How many people submitted the first assignment?*

- A.  $> 10,000$
- B.  $5,000 - 10,000$
- C.  $< 5,000$



# The “Harsh Realities”: Participation

*How many people watched the last lecture of week 6?*

- A. > 20,000
- B. 10,000 – 20,000
- C. 5,000 – 10,000
- D. < 5,000

*How many people submitted the week 5 quiz?*

- A. > 10,000
- B. 7,500 – 10,000
- C. 5,000 – 7,500
- D. < 5,000



# The “Harsh Realities”: Participation

*How many people have posted on the discussion forums?*

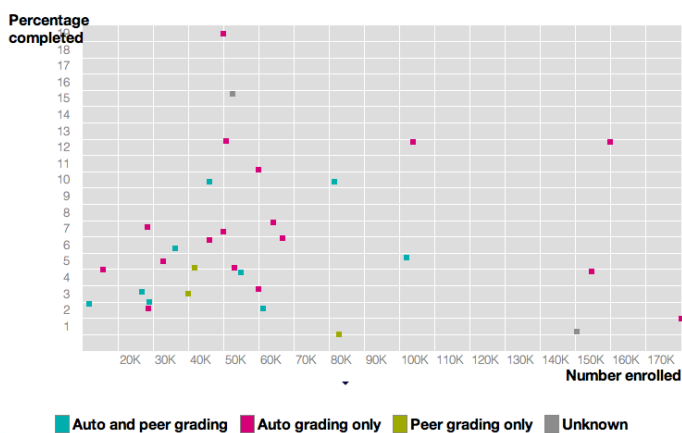
- A. > 20,000
- B. 10,000 – 20,000
- C. 5,000 – 20,000
- D. < 5,000

*We're on pace for having about 9% of our registered students earn a Statement of Accomplishment. Should we be concerned?*

- A. Yes
- B. No



# The Harsh Realities: Participation



<http://www.katyjordan.com/MOOCproject.html>



# Are MOOCs useful for you and your students?

## *Discussion Questions:*

1. How might MOOCs be useful to your students?
2. How might MOOCs be useful to you?

