TEACHING A LARGE INTRODUCTORY STATISTICS COURSE: MAKING IT WORK!

JSM 2016
Section on Statistical Education

Panelists
- Megan Mocko ~ University of Florida
- Stacey Hancock ~ University of California at Irvine
- Christopher Wild ~ University of Auckland
- Brenda Gunderson ~ University of Michigan

Chair: Roger Woodard ~ North Carolina State University

Megan Mocko ~ University of Florida

- 49,785 students
- 32,008 undergraduate students
- 16,272 graduate students
- Historically a residential campus but growing online program since 2014

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Offerings</th>
<th>Spring Offerings</th>
<th>Summer Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYBRID: 46 sections of 40 students - 1920 students total (live/online lectures with in class labs)</td>
<td>HYBRID: 47 sections of 40 students - 1960 students total (live/online lectures with in class labs)</td>
<td>In Class Only: 150 – 250 students Live Lecture</td>
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<tr>
<td>Completely Online: 100 UF Online students</td>
<td>Completely Online: 100 UF Online students</td>
<td>Completely Online: 125 students X 2 (100 students UF residential and 20-30 UF Online)</td>
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</tr>
<tr>
<td>25 student section for students with registered learning disabilities</td>
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</tbody>
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### Staff for Hybrid

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Coordinator - student centered (1 FTE)</td>
<td>Responsible for weekly quizzes, responsible for labs, lab materials, technology issues, teaches 3-4 labs per week, writes, proofs and grades exams, trains TAs, holds 2-3 tutoring hours (for a total of over 40 tutoring hours available for the students), responds to most students' emails, handles any student related problems in the lab, grades short answer labs, submits final grades, coordinates grading of labs, proctors exams.</td>
</tr>
<tr>
<td>Lab Coordinator - TA centered (.5 FTE)</td>
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</tr>
<tr>
<td>Teaching Assistants (16-18 full time)</td>
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</tbody>
</table>

### Textbook

- **Statistics: The Art and Science of Learning from Data**
  - By Alan Agresti and Christine Franklin
  - Used 1st, 2nd, and 3rd editions
  - Will use 4th edition in the Fall

### Course

- Stats 7: Basic Statistics
- 3 sections per quarter; 220 students per section
- Lecture meets three times per week for 50 minutes
- GTAs run weekly 50 minute discussion sections of 55 students each
- Service course for wide range of undergraduate students: e.g., biological sciences, political science, psychology, business, drama, art

### Stacey Hancock ~ University of California at Irvine

- ~ 32,000 students
- ~ 25,000 undergraduate students
- ~ 7,000 graduate students

Founded in 1965; one of ten UC campuses
Materials

Textbook:  
- *Mind on Statistics* (5th ed.) by Jessica Utts and Robert Heckard

Audience response system:  
- iClicker remotes  
- UCI classrooms have base stations  
- students use remotes for several courses

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Course

Chris Wild ~ University of Auckland

- Stats 10x  
- 5,000 students/year (~70% of each cohort)  
  - 1st Semester: 2,500 students  
  - Class sizes (Lecture Rooms): 300-600  
- Reputation for best organized and one of the best-taught courses on campus  
  - (national teaching award in 2003 helped establish rep)  
  - Reputation for high levels of support  
  - All teachers rate very highly with students  
- Big component of departmental budget  
  - If this course sneezes the Dept catches cold  
- Teaching team are “professionals”  
  - If you are not an excellent teacher you won’t be let near this course

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Chris Wild ~ University of Auckland, New Zealand

- 40,000 students  
- 29,000 undergraduate students  
- 11,000 graduate students  
- Residential campus

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Course

- Team teaching for over 25 years  
- Uses a single set of team-developed materials.  
  - Perfect consistency across sections  
  - Can focus on innovation and “performance” (not reinventing wheels)  
- Weekly team meeting looking back and looking forward  
- Strong all-one-team culture built and preserved over 25 years  
  - Team gets a lot of fun from working together  
  - (core troops out to morning coffee together every morning)  
- Very welcoming to newcomers and visitors  
- Aim for steady improvement rather than massive leaps (guard against unpredictable effects on numbers)  
- Efficiencies gained here allow smaller teaching loads esp to research academics
Course

FutureLearn MOOC: Data to Insight
(Another experience to draw on)
- 24 hours’ online study materials in 111 “steps”:
  - 41 videos, 16 exercises,
  - 16 quizzes, 8 tests,
  - 10+ discussions
  - and blog-discussions on almost every page
  - 30+ articles & papers

Personnel

- Lecturers (~5 in 1st semester)
- Administrator
- Help-room tutors
- Computer Lab tutors
- Student markers (large numbers)

Materials

- Workbook (updated yearly)
- Lectures – all recorded live and videos posted online
- Canvas site using most features
- Assignments & Lab sheets

Brenda Gunderson ~ University of Michigan

- ~ 45,000 students
- ~ 29,000 undergraduate students
- ~ 16,000 graduate and professional students

- Residential campus but growing online programs and learning options:
  Digital Education & Innovation (DEI), Coursera, edX, and more
Course

- **Stats 250**: Introduction to Statistics and Data Analysis
  - Covers descriptive statistics to hypothesis testing
- Primarily Freshmen/Sophomores
- Psych, Econ, Business, PolySci

Materials

- **Required**:
  - Stats 250 **Coursepack**: Lecture Notes and Lab workbook
  - Online homework tool (Course.Work)
  - iClicker
  - Calculator
- **(Highly) Recommended:**
  - ECoach
  - Text *Mind on Statistics* (MOS) 5e

Course

- LARGE = ~ 2100 students
- Weekly: 3 hours of lecture, 1.5 hour computer lab
- Coordinated across 6 lectures of 150 to 400 students, ~ 64 GSI led computer labs (30 to 35 students).

Some “Prepared” Questions to start us out

- If someone were thrust into the position of teaching a 500+ student class what practical considerations would they need to understand?
  - What course structures have you found to be particularly helpful?
  - What pitfalls should you avoid in such a large class?
- How to handle assessments?
- How to prepare teaching assistants?
- How to incorporate active learning?
- How to get to know students?
- How to address academic integrity?
Some “Prepared” Questions to start us out

- Are any quality checks done for the course? If so, describe how it works?
- What types of technology do you use?
- What is special about trying to apply the newly revised GAISE guidelines in large classes?
- What is special about applying new environments (face-to-face, MOOC, hybrid, flipped, etc.) in large classes?
- How team teaching can improve the teaching of large courses?
- What does teaching a large number of students inform us about teaching in general? Are there truths to be learned that apply to small classes as well?”

Megan Mocko ~ University of Florida

If someone were thrust into the position of teaching 500+ students what practical considerations would they need to understand?

- Detailed Syllabus
  - 16 pages long
- Be consistent!
- Double, Triple check everything!
- Be Organized – Tell the students where we are going and how we are going to get there.

Weekly Reminders for Monday, November 16th to Friday, November 20th

Lectures: MWF: Available: 8th period in RRN: 137, 7th period in Norman G520 or online

Quiz

- Off: Monday, November 19th at 8am until Thursday, Nov. 19th 11:59pm
- Three Attempts, highest counts
- Covers Material: Chapter 9 Section 3 – Chapter 9 Section 5, pages 86 - 95 in the lab workbook

Lab: Lab 9: Activity 18 Monday - Friday

- You must attend the section for which you are registered.
- Be on time. You have a 5 minute grace period.
- If one of your lab scores was uploaded incorrectly to Canvas, please talk to your TA in lab. You must bring a copy of the lab worksheet in question. All grades changes must be done by Wed., Dec. 9th. (the last day of classes).
What course structures have you found to be particularly helpful?

- Instructions in writing
- Predictable pattern each week
- Posting extra help videos

What pitfalls should you avoid in such a large class?

- Be careful what you ask for.
  - "Please let me know if you think of a good memory aid to help remember the difference between Type I and Type II error definitions. I will share them with the class." SUCCESS!
  - "So far, I have received zero questions for the Q and A tomorrow, if I don’t receive any there won’t be a review." Success, yes, manageable, no

- It helps to be little bit paranoid.
  - "Tell students for two weeks prior to the exam that there will be an extra set of questions on the exam. Explain on the exam that there is an extra set of questions on the exam. 30+ students stopped at “33” the typical number of questions on our exams." Not good!
  - “Do all of the above and add a question on the exam that asks how many questions are on the exam” Success!!
How to Handle Assessments?

- 3 multiple choice exams
  - Check and Re-Check Exams before Printing
  - Have five other people complete and check the exam as well
  - Across 15 – 18 rooms around campus
  - All graduate students help proctor
- 10 (weekly) multiple choice quizzes
- 10 (weekly) labs
  - Labs include short answer questions and interpretation statements
  - Active Learning Environments

Exam Nights

- Meet with all graduate students 1.5 hours prior to exam.
- Eat pizza together before going out to exam rooms.
- Explain the procedure verbally and in writing.
- Have a policy for late students to the exam.
- Extra calculators, pencils, etc. for each room.

How to Prepare Teaching Assistants?

- Two hour Training Session at the beginning of the Semester
- Ten one hour training sessions before each lab
- One hour training about entering grades for new graduate students
- One hour “Best Practices” activity in the Spring

“Scripts” for Lab

- TALK: The purpose of today’s lab is to talk about calculating and interpreting the confidence interval for the population mean. Suppose that I am interested in determining the average numbers of hours that students spend sleeping. So, I decided to randomly select 100 students at UF and ask them how many hours they slept last night. Out of that sample, the sample average number of hours slept was 7.1.
- ASK: Does this mean that all UF students sleep 7.1 hours a night on average? No.
- TALK: We want to determine what the mean number of hours slept for the population of UF students. To do this, we can make a confidence interval for the population mean. This will give us a region in which the population mean is likely to be.
- TALK: The general format of the confidence is estimator ± (z or t) stderr.
- WRITE: estimator ± (z or t) std error.
“Scripts” for lab (con’t)

Part 3 and Part 4 –

- **WALK:** Talk to the groups and see if they have any questions.
- **SHOW:** Now, do this in Minitab. Go to Stat > Basic Statistics > One Sample t. Select the value of C1 as “Samples in Columns” value. Select the Graph options and choose “Boxplot”. The 95% confidence interval is the default setting for Minitab, but if you want to change it, go to Options and enter a new value.

- **TALK:** Now, work through part 5 of the lab worksheet.
- **WALK:** Talk to the groups and see if they have any questions.
- **WAIT:** After they have been working on it for about five minutes.
- **TALK:** There are two statements that are true.
- **DISCUSS:** Go over the answers.

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**TA evaluation visits**

- Once per year.
- Rated on following classroom procedure.
- Engaging the class.
- Rotating between groups of students.
- Explanation of the material.

<table>
<thead>
<tr>
<th>STA 2023</th>
<th>TA Visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA Classroom Visit Form</td>
<td>Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab starts on time.</td>
<td></td>
</tr>
<tr>
<td>Attendance taken and old worksheets returned after first 5 minutes.</td>
<td></td>
</tr>
<tr>
<td>Course assignments displayed and any important ones emphasized.</td>
<td></td>
</tr>
<tr>
<td>Last students were handled appropriately.</td>
<td></td>
</tr>
<tr>
<td>Lab purpose and background material explained appropriately.</td>
<td></td>
</tr>
<tr>
<td>TA is prepared to teach the activity.</td>
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</tbody>
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**What Types of Technology do You Use?**

- Canvas Course Management System
  - Email based on grade of assignment
- Minitab
- Applets
What is special about trying to apply the newly revised GAISE guidelines in large classes?

- Change is very hard!
- Two new emphases
  - Give students experience with multivariable thinking.
    - I added an example to the lecture last year.
    - This Fall, we updated the example and will re-enforce it with quiz and exam questions.
  - Teach statistics as an investigative process of problem-solving and decision-making.
    - Challenge the status quo. This will be more difficult.

Also, what does teaching a large number of students inform us about teaching in general?

- Format of assessments (electronic versus paper)
- Multiple Attempts for Assignments (actually practice more)
- Feedback (although I can give more feedback on written returned paper assignments, the automatic feedback for large classes is helpful here as well.)

How to get to know students?

- Beginning quarter survey
- Office hour log
- Active learning – move around the room during clicker questions or group work

Stacey Hancock ~ University of California, Irvine
How to address academic integrity?

- Detailed expectations and definitions in syllabus
  - what is academic dishonesty?
  - what are the consequences?
  - why are we here?
  - focus on respect, community, pride, honesty
- Open dialogue at the beginning of the quarter
  - clicker questions

What types of technology do you use?

- **R Commander (Rcmdr)**
  - Free and open source
  - R library
  - GUI
- **iClickers**

Brenda Gunderson ~ University of Michigan
How to Incorporate Active Learning?

- **Coursepack**: Lecture Notes and Labs
  - Initially incomplete, students are co-authors work with instructors to complete and create own study guide
  - Instructors use doc cam or tablet to guide

How to Incorporate Active Learning?

- **iClickers**: Lectures and Labs
  - Offers Low Stakes Assessments in class
  - Provides useful, actionable data
  - Incentive = cartwheel

What Types of Technology do You Use?

- **Canvas Course Management System**
  - Homepage = one stop shopping for resources
  - Announcements
  - Groups
  - Virtual Office Hours
  - Admin GSI helps to maintain site

What Types of Technology do You Use?

- **R / R Commander** (since Spring 2015)
  - Drop-In R Install Sessions
  - R Help Email
  - Prelab Videos each week

- **HyFlex Lecture and Make Up Lab Option**
  Dr. Jackie Miller (jabmille@umich.edu)
What Types of Technology do You Use?

- **Online HW Tool = Course.Work**
  - Open/close at same time
  - GSI graded with rubric and feedback given
  - No “lost” HW
  - Instructors can ‘see’ any HW
  - Lots of data

- **Online Applets and GSI created Shiny Apps**

- **Home-Grown Practice Resources**
  - Problem Roulette and Name That Scenario

What Types of Technology do You Use?

- **ECoach ~ personalized tool**

How to Handle Assessments?

- **10 (weekly) online HW required** (also set of recommended questions)
- **10-12 (weekly) labs**
  - Prelab Assignment (due before lab)
  - Warm Up Questions
  - Group ILP (in-lab project often using R/Rcmdr)
  - Cool Down Questions
  - Ticket (out the door)
- **2 semester exams and 1 comprehensive final**
  - Paper Exams (not all MC)
  - Exam 101 session to train grad students (monitor Yik Yak exam day/night)
  - Group Grading Session (rubrics)
  - Future = Scanning in graded exams

Two Methods for Final Grade: differ in weighting of exams