Stories of Course and Curriculum Transformation

Faculty panel
Provost's Seminar on Teaching
October 5, 2016

Cindee Giffen cgiffen@umich.edu

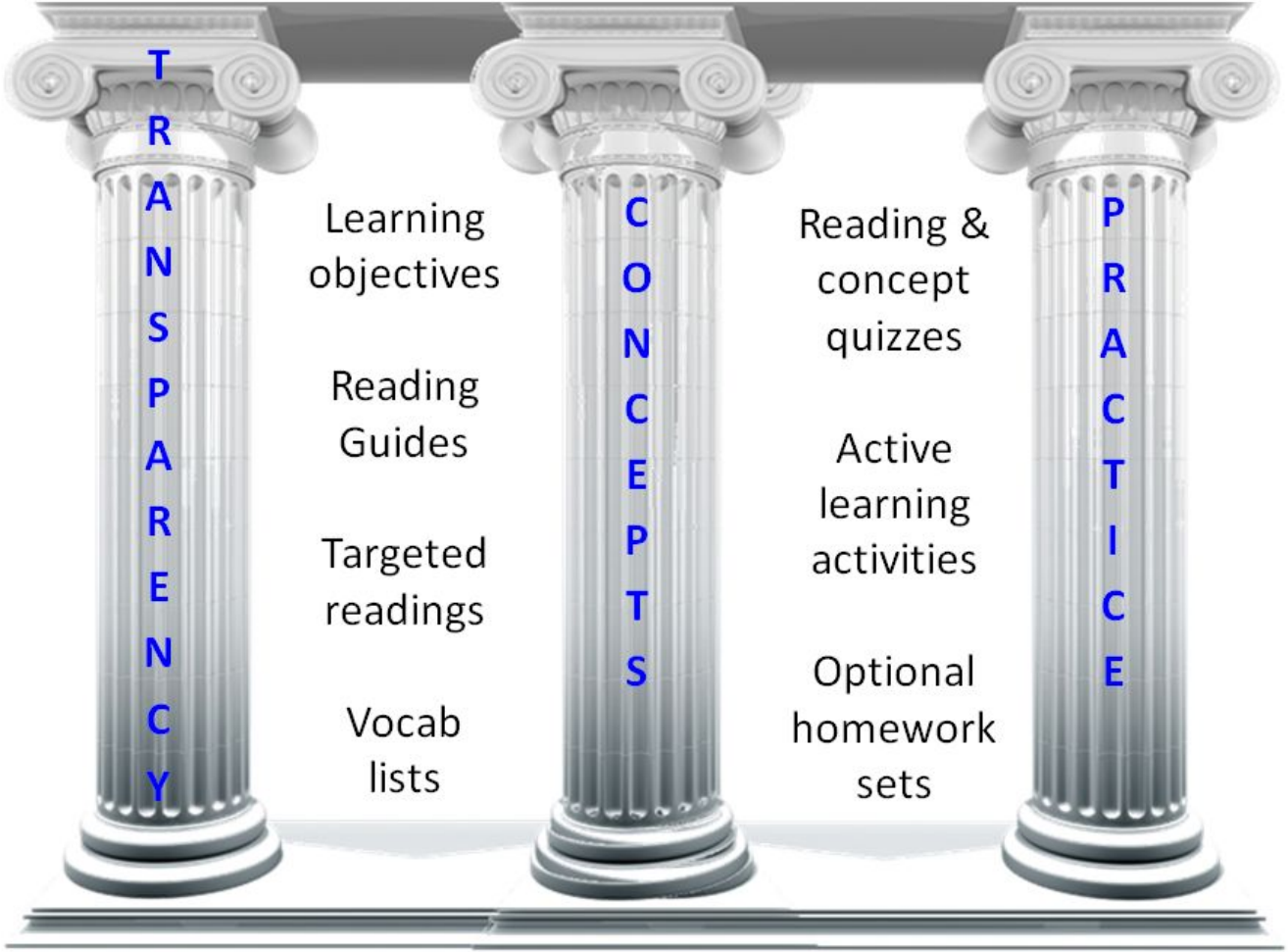
Introduction to Ecology & Evolutionary Biology (Bio 171)

- ~600 students/semester
- Freshmen & sophomores
- Interested in bioscience majors
- One of two lecture & discussion-based courses in our majors introductory sequence
- Course redesign in Winter/Fall 2014

Motivation

- Too much content
- New instructional team with interest in best practices from literature
- Gender gap
- Desire to help all students do better & learn more

Introduction to Ecology & Evolutionary Biology



Outcomes

- Benefits of frequent quizzing & homework sets
- Better alignment
- More challenging exams with better scores
- Fewer adverse outcomes (D, E)
- TBD: Retention? Gender gap?

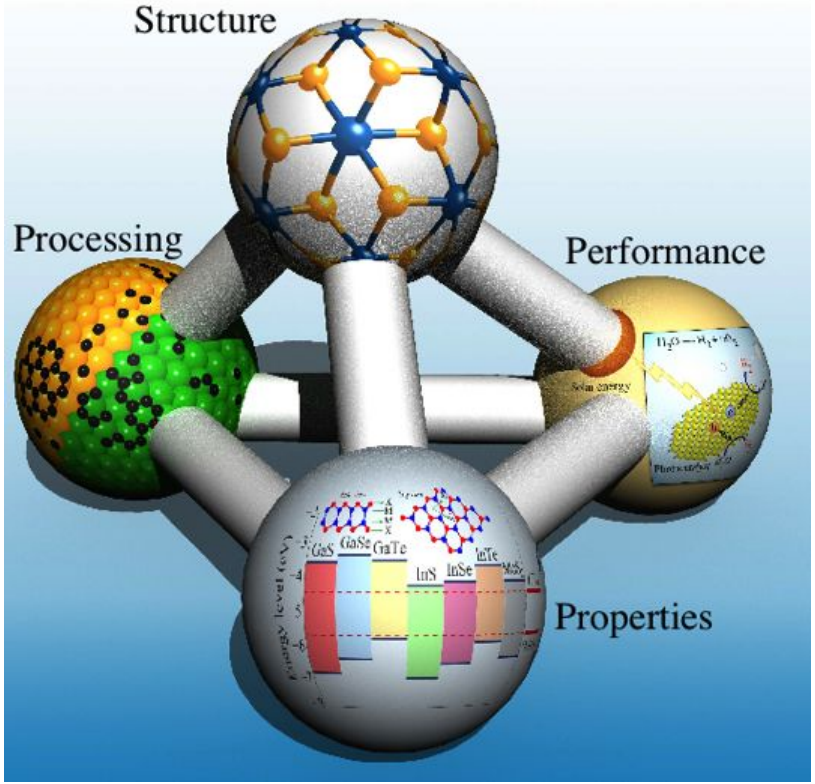
John Carson, Associate Professor and Director of Undergraduate Studies

History 202

Developing a New Course in a New Curriculum

Rachel Goldman, Professor of Materials Science & Engineering

MSE 250: Principles Engin Matls

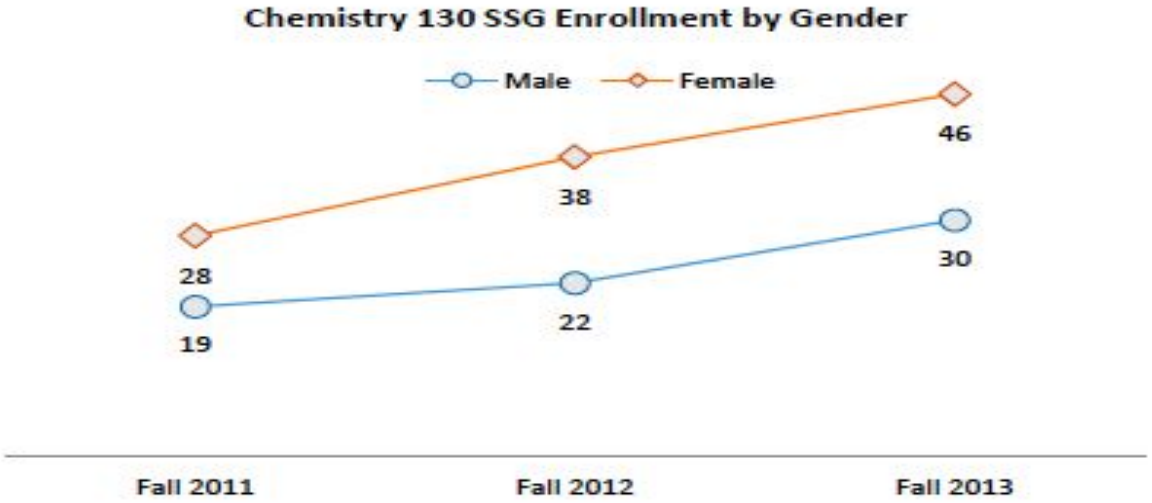


http://hennig.mse.ufl.edu/wp-content/uploads/sites/30/2014/09/Materials-Science-Tetrahedron-for-2D-Materials.png

Materials Science Curriculum

Prereqs	Survey Course	Basics	Methodologies
Chem 130 (GenChem) or Chem 210 (Organic) + Math 115/116, 215/216 + Physics 140/141, 240/241	**MSE 250** (Principles Engineering Materials) or MSE 220 (Materials & Manufacturing)	MSE 350 (Structure of Materials) + MSE 242 (Modern Physics for MSE)	MSE 330 (Thermo-dynamics) MSE335 (Kinetics) MSE 420 (Mechanical Properties) MSE 400 (Electronic Materials)

Motivation: Increase participation of under-represented groups in STEM



Women over-represented in Writing-to-Learn Study Groups => apply to other STEM courses!

Writing-to-Learn Assignments

Short informal assignments (<150 words) will focus on topics presented through the readings and lectures (10 points each, ~2/week)

Longer assignments (350-500 words) will focus on foundational topics of the course. For the longer assignments, you will submit multiple drafts of your work, as well as participate in peer review of the work of others (20 points each submission/revision + 20 points peer review, 3-4 total)

Developing Students' Thinking by Writing

https://tomprof.stanford.edu/posting/1472

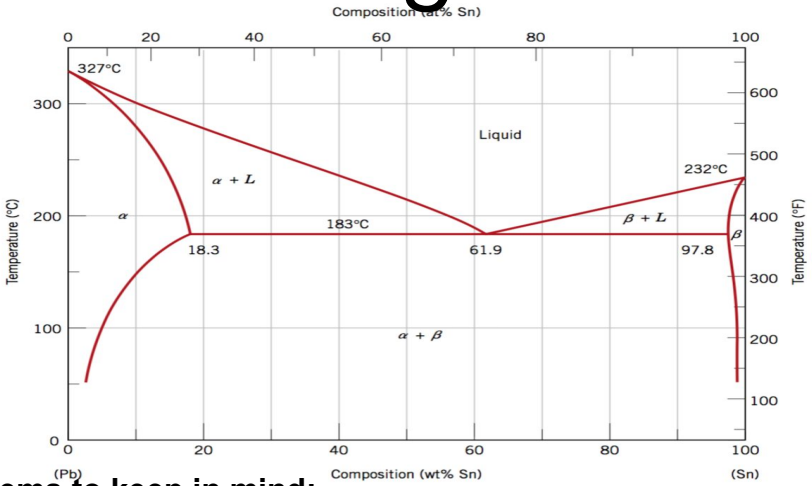
Write to Find out What We Are Thinking and to Learn

https://tomprof.stanford.edu/posting/1486

“Exploratory Writing”

- What was the most interesting/important thing that you learned this week?
- What are the most interesting and/or challenging aspects of the upcoming chapter(s)?
- What questions do you have? What concept(s) are you still confused about?
- Relate a concept from this weeks reading to something in our everyday lives.
- Which topics on the exam did you understand well?
- How do the concepts we are covering this week relate to topics covered in your other courses?

Writing-to-Learn: Phase Diagrams



Objective:

You have been hired as a consultant for GM to determine why a Lead-Tin solder failed. This solder was chosen because it has a eutectic point at the low temperature of 183 ^{o}C. However, when GM uses the solder they find that they do not achieve total melting even at a temperature of 200 ^{o}C. Upon analyzing the solder, you determine that the wt% Sn is 50%. Using discipline specific terminology and referencing the above phase diagram, write a memo explaining to one of their CEOs why the solder didn't melt at the expected temperature. In your discussion use the lever rule to give the percent α and percent L phase of the solder at 200 ^{o}C and what temperature the solder would need to be heated to for it to melt completely.

Items to keep in mind:

- When we read your memo, we will play the role a CEO with minimal scientific background who is trying to understand the science behind why the solder failed.
- Describe the names of the important points, lines, and phases that are denoted in the phase diagram.
- Detail how you used the lever rule to determine the percent phase fractions of the solder.
- Include a discussion about how microstructure of the solder will affect the performance of the solder.
- External references are not required, but if they are used they should be cited using MLA format.
- Since you are trying to persuade the CEO of your credibility as a consultant, you should take care to carefully edit and proofread your memo.
- This should be a memo of between 350-500 words.

Outcomes of Writing-to-Learn

Exploratory Writings

"I like the exploratory writing and writing to learn sets, they are like extra practice on how to use the material learned in class and apply to real-life designs."

"These exercises are really nice for giving reliable feedback about what students are having trouble with/ what they understand well. They seem to be more a diagnostic tool than a teaching tool but you need both and they worked great."

"Easy to complete and agree with what they strive to accomplish (reflection, looking forward on material)."

Writing-To-Learn

"These exercises were extremely useful at making long term memories of the learned material, as well as gaining an appreciation for it's understanding. They were also a refreshing change of pace from many of the quantitative problems…I think the peer review was equally useful, just seeing how another person tackled the problem, phrased it, and organized their memo's was great."

"The writing to learn assignments were my favorite part of the class because it gave me the sense of applying knowledge from class to real-world situations…This was a fun task to do and receiving and writing peer reviews also greatly improved my quality of writing."

"The longer exploratory writing problems were interesting and helpful, and I'm sure will help me retain the content long-term."

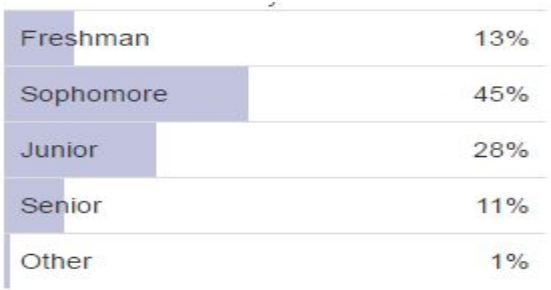
"I believe that these should be instilled in other classes. Writing for Engineers is not something required very often so it's nice to be asked to periodically. Writing about a concept for 300-500 words requires you to gain a good hold on the material."

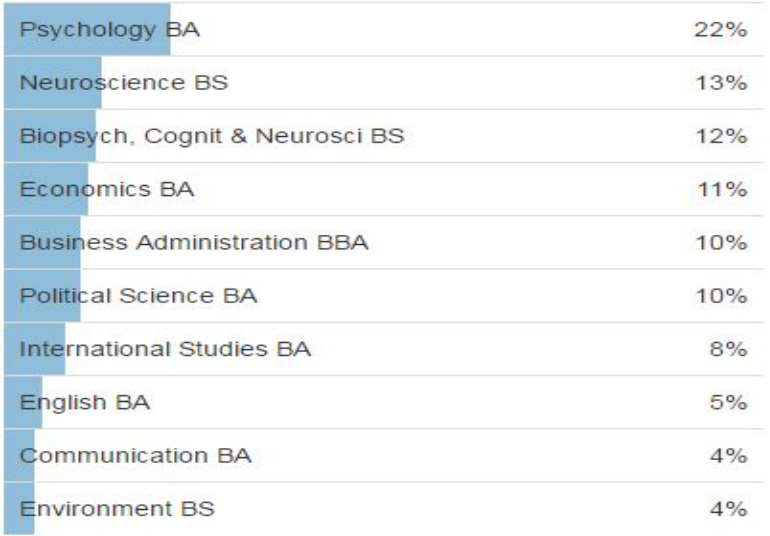
Brenda Gunderson

Stats 250 Info

via **A**cademic **R**eporting **T**ools

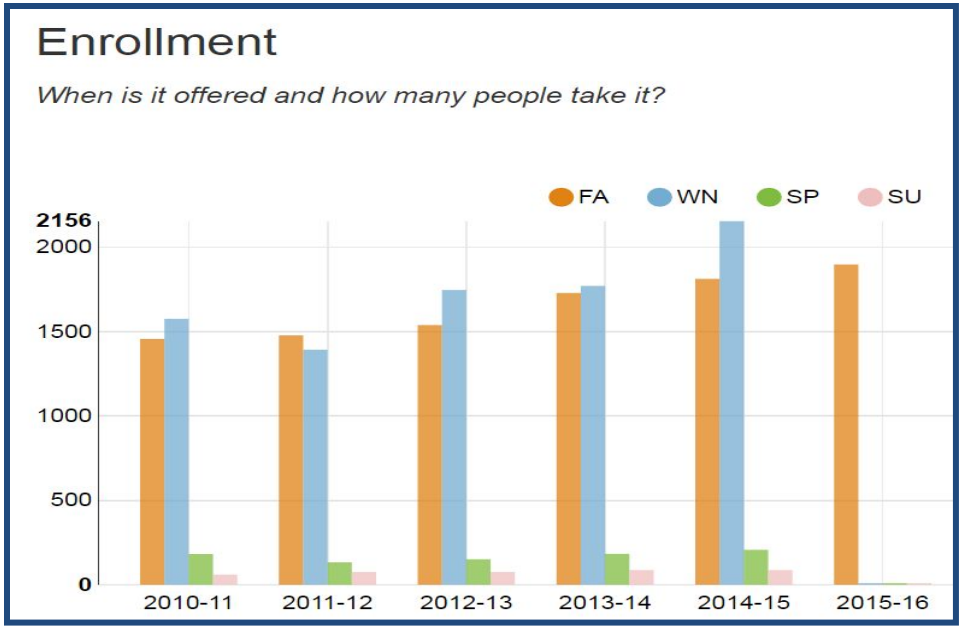
- Covers **descriptive statistics to hypothesis testing**
- Primarily Sophomores
- Psych, Econ, Business, PolySci





Stats 250 Info

- **LARGE**
  ~ 1800-2000+ students
- **Weekly:**
  3 hours of lecture,
  1.5 hour computer lab
- **Coordinated**
  across 6 lectures
  of 150 to 400 students,
  ~60+ GSI led computer labs
  (of 30-35 students).



Stats 250 Canvas Home Page

Point-Free Practice Zone Real Exam Questions from Past

Links to Commonly Used Resources

Prelab Tutorials

Practice Exams

Problem Roulette

Course.Work

Homework Tool

E² COACH

Stats 250 ECoach

NTS

Name That Scenario

R

R Information

YouTube

Stats 250 YouTube

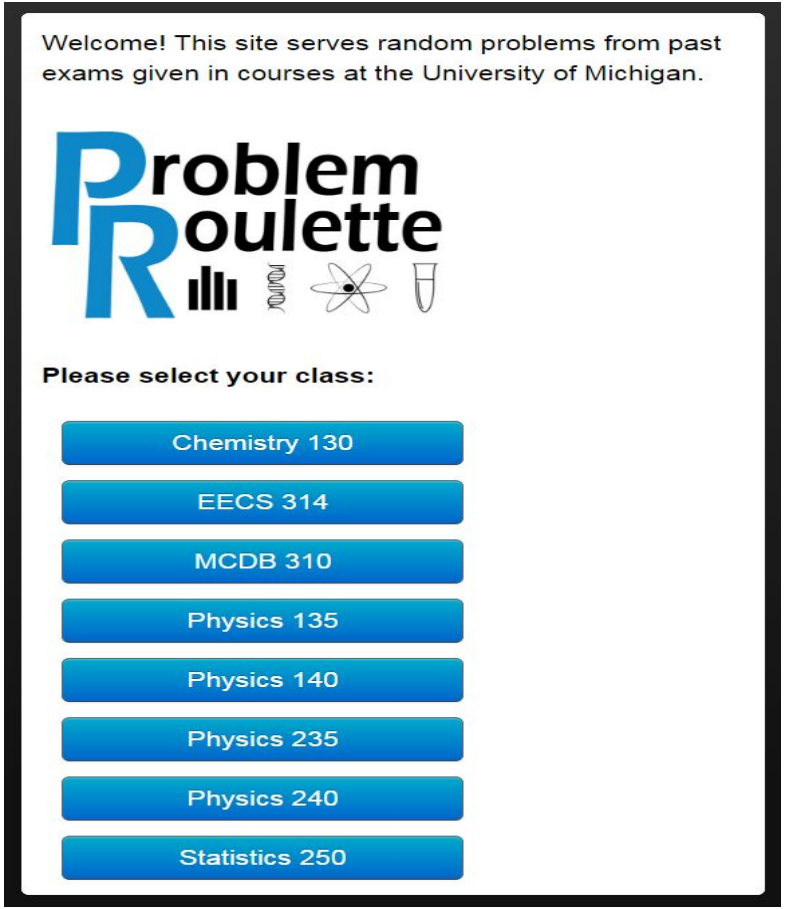
$$\sqrt{\sum (x_i - \mu)^2 p_i}$$

Formula Card

Department of Statistics Tutor List

Student Support Services at UM

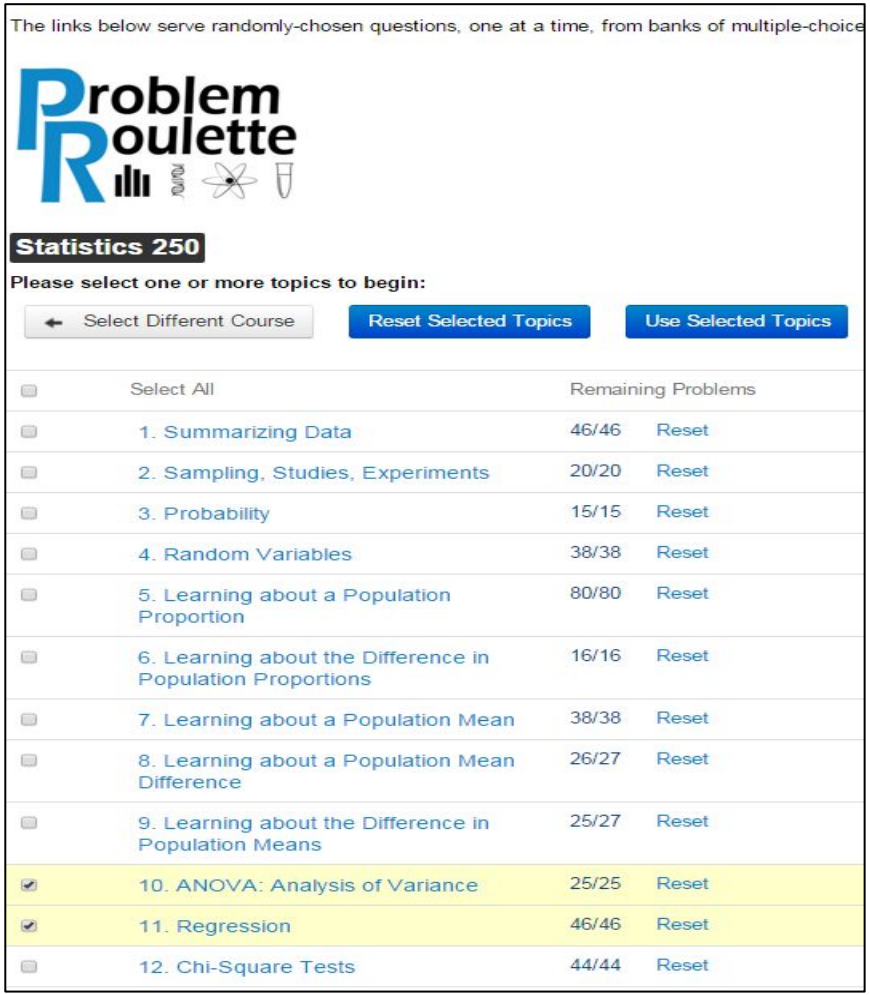
BlueCorps is open 10-4 everyday in 2001 MLB, stop by for technology and online campus resource help!



Study Tool that randomly serves up past exam questions for selected topics

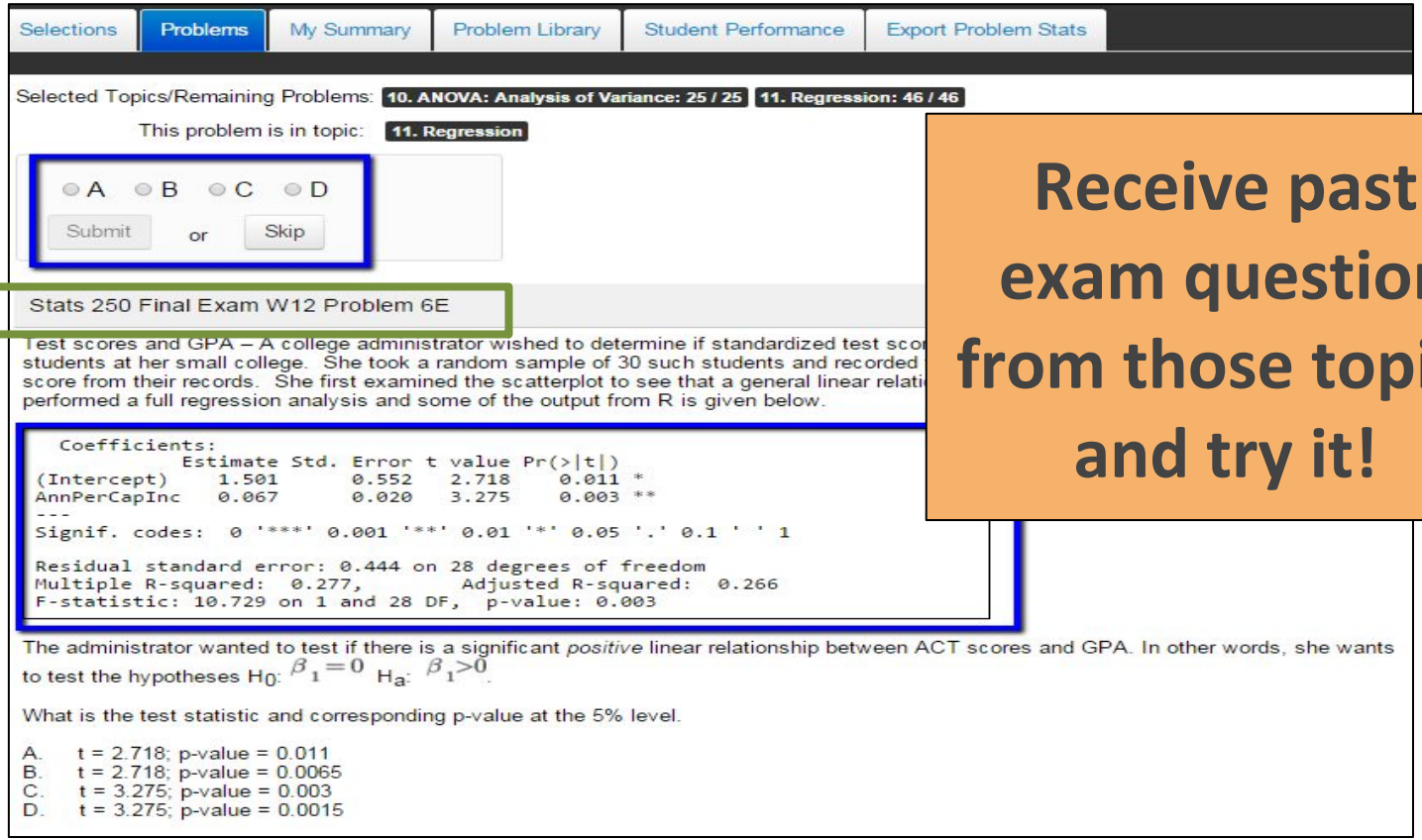
Currently serves **8 STEM courses** across **5 departments**

Began 2011 ~ Stats 250 joined 2013



Pick your Topics

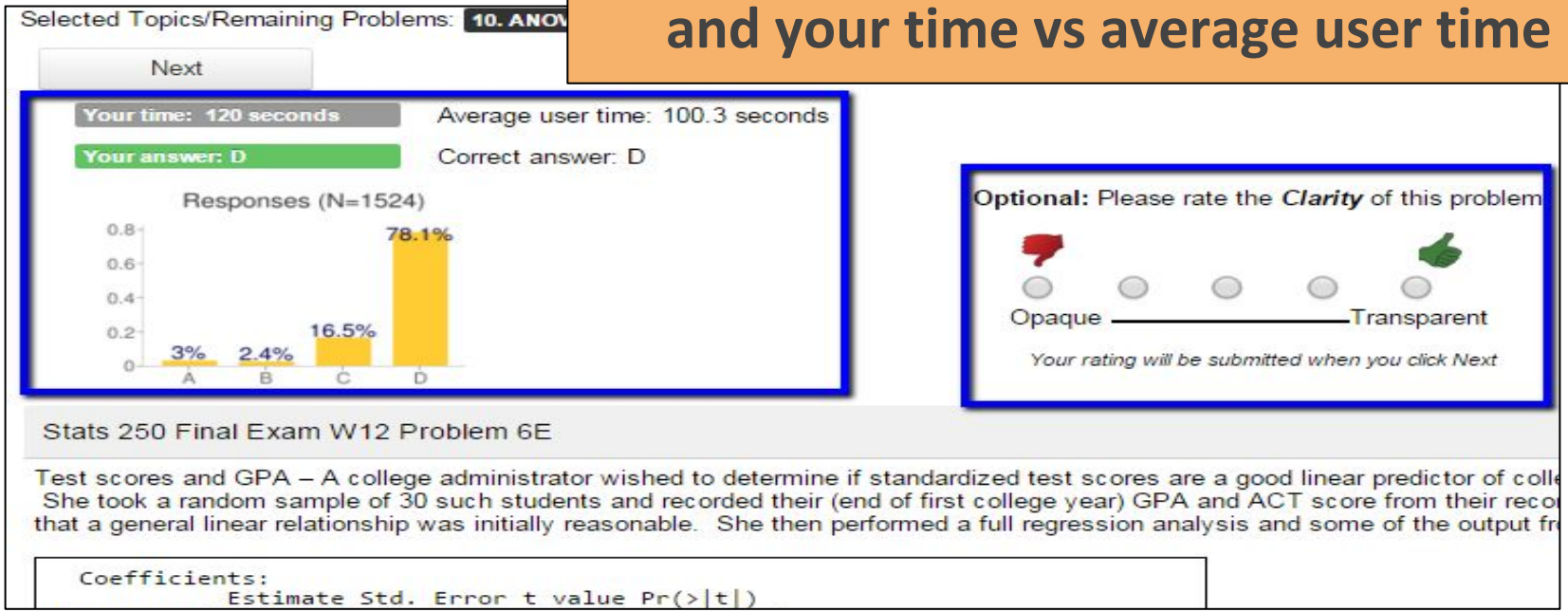
Stats 250 Problem Roulette



Receive past exam question from those topics and try it!

Stats 250 Problem Roulette

How did you do? Histogram of responses and your time vs average user time



Stats 250 Problem Roulette

Nice Summary Tab

Filter for list of those missed so can review and productively struggle with them more and bring these to office hours

PR Generates Lots of Interesting Data: Stats 250 PR Usage F15

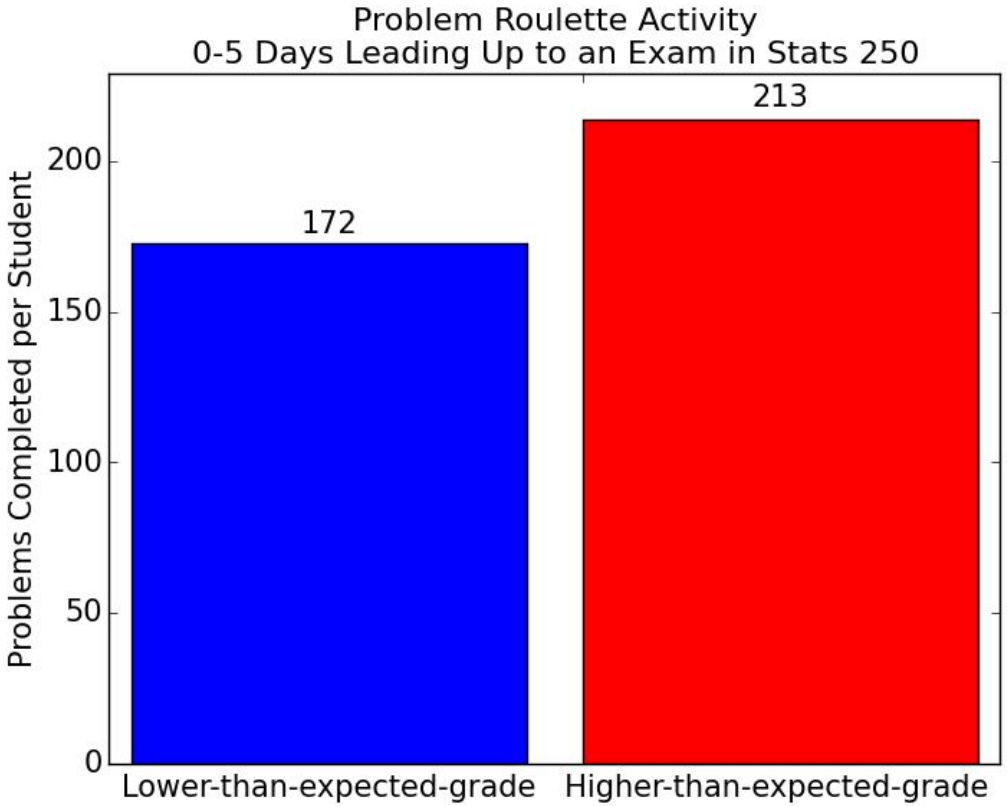
Guess how many exams?

Many other analyses conducted and ongoing…

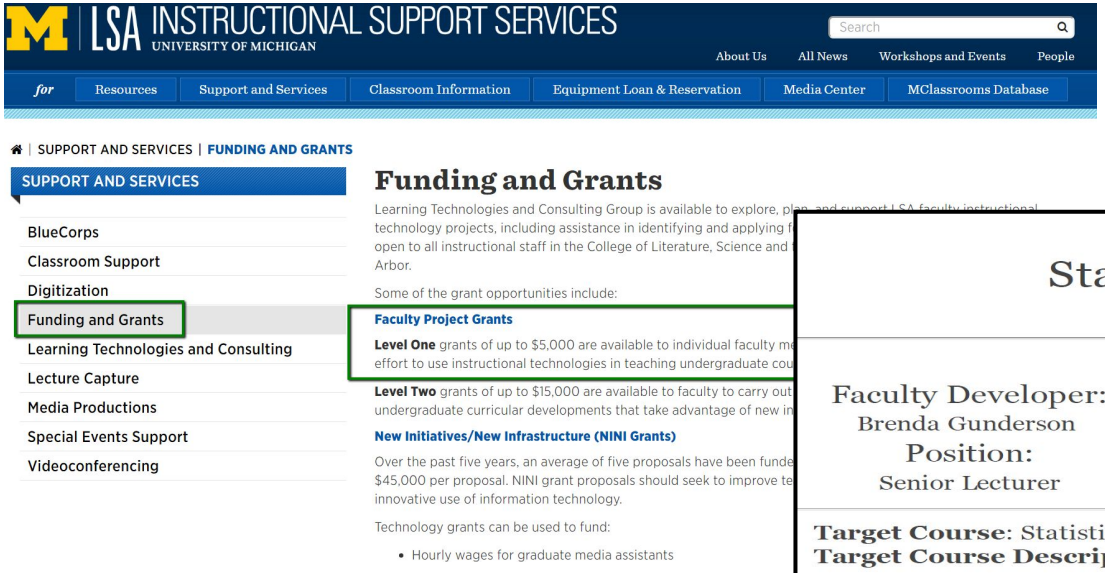
* 0.1–0.3 final grade point boost for regular users
* reduced gender bias (relative to final grade)
* A-students: 1-day earlier, ~50% more problems than non-A

PR Generates Lots of Interesting Data

Overachievers did ~25% more problems than underachievers



Stats 250 PR: How did we get started?



Stats Joined ECoach
→ Heard about PR
→ Level 1 Fac Grant

Statistics Problem Roulette

Faculty Developer:	Grant Level:	Telephone:
Brenda Gunderson	Level I	734-763-3519
Position:	**Department:**	
Senior Lecturer	Statistics	

Target Course: Statistics 250
Target Course Description and History:

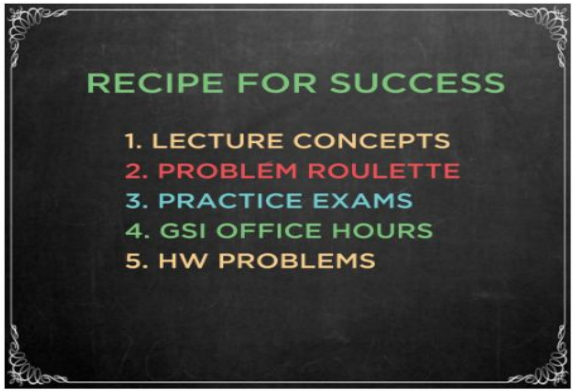
Personnel Support Needed:

Support for Graduate student in Statistics to be trained on the program, to create/convert content, enter the content (questions and solutions and images), test the system, analyze data resulting from the use of the system.

Support for the Physics Problem Roulette Consultant Michael Mills <mcmills@umich.edu>

Stats 250 E^{2}Coach PR advice from past student

A story: A good addition



Using Problem Roulette for Exam 1

First, I went over concepts from lecture that were confusing or reviewed multiple times in lecture. I watched a few videos, went through the coursepack, and looked over some problems again.

Second, I did **all the problem roulette problems without any notes**. This was the first time I was doing problems without relying on the notes, which allowed me to really assess how well I knew the concepts.

Next, I did one of the two practice exams (also without my notes), after I had done every problem in Problem Roulette that I could do, I went to GSI office hours to talk about any of my weaknesses — whether that was a problem roulette problem that I just couldn't get or an overall topic that I needed more help with.

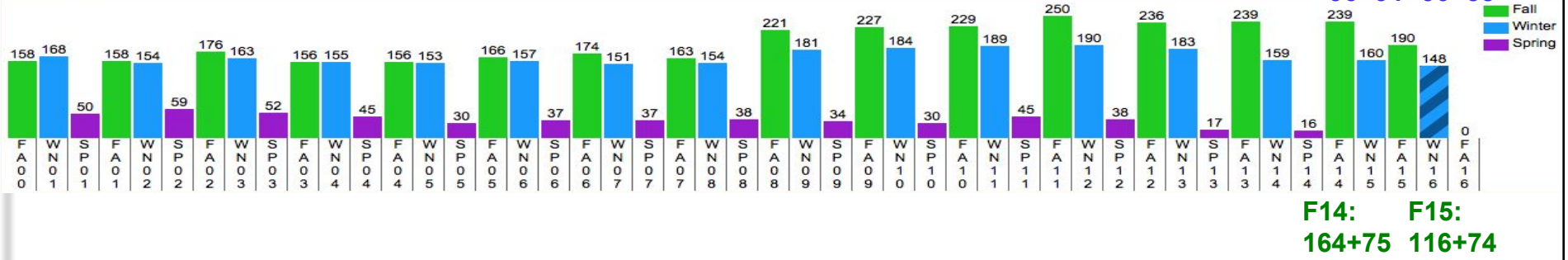
Last, I took the second practice exam. At that point I just looked over HW problems and confirm that I was comfortable with everything.

~ Former student, Fall 2015

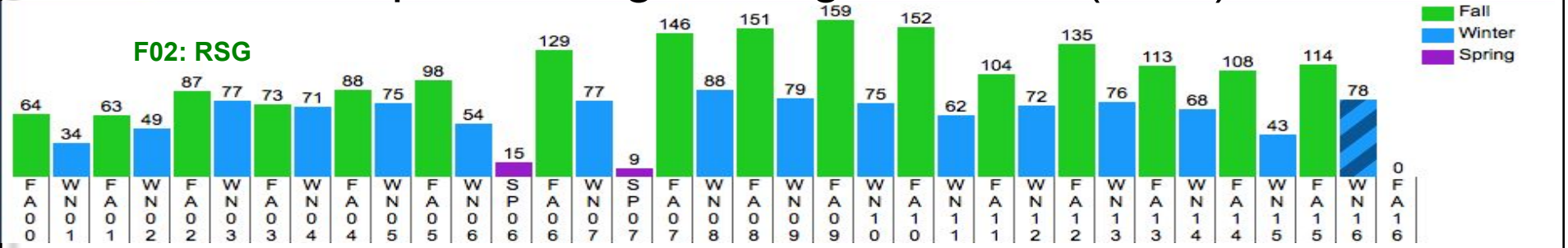
Back-up Slides

MSE 220 & 250: 2000-2016

MSE 220: Materials & Manufacturing (2 lecs)

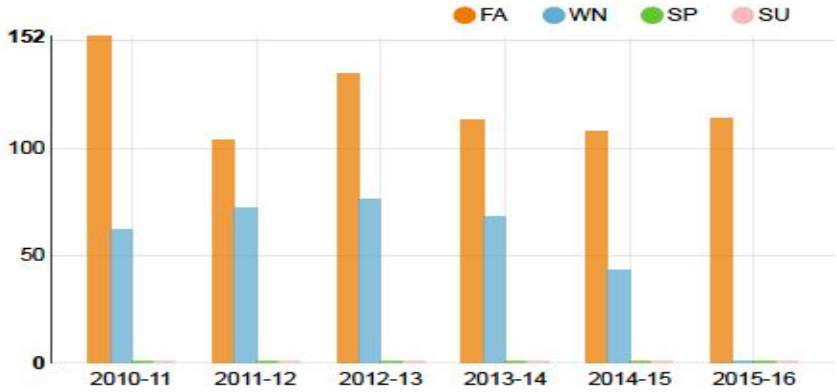


MSE 250: Principles of Engineering Materials (1 lec)



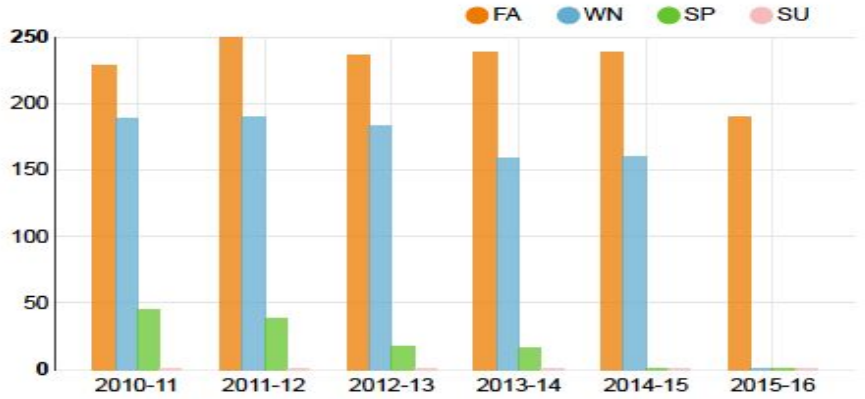
MSE 220 & 250: 2010-2015

MSE 220: Materials & Manufacturing



IOE 33%
ChemE 24%
NERS, MSE 5% IOE 4%
EE, AERO, CSE 2%

MSE 250: Principles of Engineering Materials



BME 49%
ChemE 18% MSE 13%
IOE 5% NERS 4%
EE, AERO 3% ME 1%