Write what? I thought this was a Math class.
Incorporating real data analyses with written assignments to improve Business Statistics application.
Amy Luginbuhl Phelps, PhD
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Three Educational Forces
- Three major educational forces were coming together in the late 1990's
  - Experiential learning
  - Service-Learning
  - Statistical Reform producing the GAISE guidelines: ASA, 2005
    http://www.amstat.org/education/gaise/GAISECollege.htm

Experiential learning
- Angelo and Cross, 1993
  - Students learn more when they take an active role
- Newmann, 1992
  - "Psychological Investment": Combining traits of purpose and caring give students ownership and connection to real world

General Public Plea for SL
- Campus Compact formed in 1985
  - Followed scattered activities of 60's and 70's
  - Initiated by Brown and Georgetown, now has more than 1,100 membership
- Bok, 1990 (Former Harvard President)
  - Universities failing to teach students to respond to pressing social issues
- National & Community Service Act 1990
  - $275 million allocated for SL from K thru higher education

GAISE Guidelines
1. Emphasize statistical literacy and develop statistical thinking.
2. Use real data.
3. Stress conceptual understanding rather than mere knowledge of procedures.
4. Foster active learning in the classroom.
5. Use technology for developing concepts and analyzing data.
6. Use assessments to improve and evaluate student learning.

Classroom activities/Assessments
- How many times per semester do you
  - Use REAL data, not ‘real’ datasets from textbook
    - Generated by current research
    - Generated by the student(s)
    - Grade student generated
      - Graphs
      - Excel/software analyses?
    - Grade written interpretation/summary statements with business applications
  - They have to DO statistics with technology
  - They need to be held accountable (graded)
**Communication**

- **Written**
  - Students have to write
  - Summary paragraphs
  - Inference and applications to business problems
- **Oral**
  - Be able to present to a general audience
- **Technical**
  - How to tell technology what you want
  - Communication with Excel/statistical software

**Business Statistics I**

- **Study/survey design**
- **Data collection**
- **Graphical and numerical summary**
- **One sample inference**
  - Confidence Intervals
  - Hypothesis testing
- **Communication (written/technological) skills**
  - Through bi-weekly lab assignments
  - Interpretations Excel/StatCrunch outputs on quizzes and exams

**Business Statistics II**

- Modeling and relationships
- Two-sample t-test
- Chi-square test of independence
- ANOVA
- SLR and MLR
- Introduction to time-series, non-parametrics and/or data mining (instructor choice)
- Verbal and written communication
  - Addition of student generated research projects presented the last week of class

**Lab reports**

- **Text:**
  - *Business Statistics, 2nd* Sharpe, DeVeaux, Velleman
- **Plan–Do–Report style**
  - Get them used to what actions/plans/purpose for collecting the data.
  - Graphical numerical summary and analysis
    - start small, add and grow with each Lab
    - cumulative and repetitive
    - each subsequent lab uses techniques from previous lab
- **Work in pairs**
  - Helps reduce grading time

**Biweekly Labs (Stat I)**

- **Descriptive Statistics**
  - One and two-way pivot tables
    - Bar/pie charts
    - Row/column percent → joint, marginal, conditional
    - Histograms, scatterplots
    - Mean and sd
    - Median and Q1–Q3 → boxplots
    - Trendline/linear model
  - Sampling activity to collect own data (or SL)
    - Use own data to
    - Construct CI
    - Hypothesis testing

**Assessments**

- **Provides Excel/StatCrunch outputs**
  - These include summary stats, graphs etc...
- **Emphasize business interpretations and applications of results**
- **Exams**
  - I allow the students to generate their own formula (cheat) sheets.
  - I provide practice exams
  - I write my own questions
Projects

- Stat I – Labs 4/5 combined using data we collect ourselves ('capstone' for Stat I)
  - Thanksgiving data
  - Tangrams (S. Kuipers)
  - NSF 2011 Grant 'Playing games with a Purpose'
- Service–learning projects
- Stat II ('capstone' for Stat II)
  - Either student generated
  - Or Service–learning project

Service–Learning Projects

- Meet with CP 2–3 times
  - Understand organization and needs
  - Determine what activities class can do to emphasize learning goals and assist the organization (reciprocity)
- Proposal—Briefly outline
  - what is expected of instructor, students, CP
  - Tentative timeline of when tasks will be done (align with student project tasks)

Class Activities

- Meet the CP and organization
- Get HIPAA certification if necessary
- Embed service project in classroom activities
  - Create survey, data collection design
  - Schedule data collection and data entry
  - Use real-time data collection to emphasize concepts in class
  - Final presentations and reports
- I accomplish some of these activities through bi-weekly lab assignments

Too Much work!?

- Perhaps, but the benefits are
  - It feels like the right thing to do to
  - Help students learn and
  - Get excited about statistics (... well, maybe?)

More benefits

- Doing something REAL and they can see its importance in real time
- It helps me to stay ORGANIZED and on track.
- I have readily usable data they understand to use classroom resources to present
  - data problems we have to deal with
  - new statistical techniques
  - use for classroom quizzes, exams, ...

Student Oral Presentations

- Student research projects
  - Forces students to be accountable for material they need to learn
- SL projects
  - Provides the opportunity to present data to real professionals and
  - Field questions from real professionals
**SL project example**

- By the end of a two-semester SL project
- Two Programs for county foster teens
  - Residential
  - Community-based educational
- 600 cases
  - ~300 client applications
  - ~200 accepted in residential program
  - ~100 community-based educational program
- 86 variables

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**Student Presentations**

- Wow! It truly all came together
- The students presented to the executive directors of the organization
- They answered questions
- Fall semester
  - The students presented preliminary descriptives and potential trends thus fielding questions for future analyses
- Spring semester
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**Executive Director Quote**

“…based on the results presented by the students, Ward Home has made changes in how they operate and how they compile and store their records.”

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**Executive Director Quote**

Although we are just students learning, I feel we all came together to give Ward Home, Inc some really valuable statistical information…

...when we told them the results, they were surprised things were different than they thought and it can help them improve their organization.

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The project definitely tested the abilities I learned this semester...it is wonderful that we were able to give back while learning valuable information ourselves.
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