Group Learning, Contextual Projects, Simulation Models and Student Presentations in Enticing Engineering Statistics Students

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Outline

- Objectives, goals and material problems
- Group Work (cooperative learning)
- Weekly Homework and Presentations
- Support Tools (Minitab and GPSS programs)
- Support Materials (Web Readings)
- Group Final (Contextual) Projects
- Testing and Grading Schemes
- Examples of Course Work
Problem Statement

• One course to teach everything in stats  
  – As prerequisite for all other MS courses
• Lack of interest on the student part  
  – Stats is not their main college interest
• Weak student stats background  
  – Most never took stats, or did so long ago
• Stats has a bad reputation among students
Solution: Teaching Approach

- Problem
- Poor Background
- Weak Students
- Mathophobia
- Extensive Material
- Lack of Interest
- Passive attitude

- Solution
- Tutorials (STARTs)
- Learning Groups
- Stats Software
- Division into Classes
- Contextual Projects
- Student Presentations
Course Goals and Objectives

• Learn applied engineering statistics
  – Theory (why) and practice (how to)
• Multidisciplinary, team work environment
• Other Specific work skills
  – Problem solving using statistics
  – Oral/written presentation skills
  – Synthesis/summarization skills
Course Content

• Part I: Descriptive and Probability
  – Data, EDA, distributions, transformations
• Part II: Inferential
  – Confidence intervals, hypothesis tests, SPC
• Part III: Modeling
  – Regression and ANOVA

• http://web.syr.edu/~jlromeu/Syllabus.html
Creation of Study Groups

• Size: four to six students
• Selected by assignment on first day
• Internal democracy: elected leader
• Division of labor within the group
• Constant email communication among all
• Homework presentation every week
• Final Project at end of the course
Group Role and Procedures

- Group work is the basis of the course
- Select own final project, leader, etc.
- Meet weekly (in cyberspace and real)
- Divide homework among them
- Put it back together for the presentation
- Group members learn from each other

http://web.cortland.edu/romeu/groups.html
Division of Topics into Classes

• Too many topics with too many parts
  – Divide into classes (of “equivalence”)
  – E.G. the class of confidence intervals
• Each group works on a class element
  – All groups cover the entire waterfront
  – E.g. one group works on CI for the mean
  – Another, for CI for the proportions, etc.
• Then, present in class and share materials
Assignment of HW to Groups

- Sent by email to students and groups
- Tutorials (STARTs) and case studies
  - Readings in the internet, as examples
- Students learn to decompose problem
  - Each works on a task individually
  - Then, puts problem tasks together
- Power point presentations in class
Cooperative Learning Objectives

• Learn to work in groups
  – Learn to get along with others
• Learn to scope/divide a problem into parts
• Learn communication skills:
  – Use of Power point and Excel software
  – For the oral and written presentations
• Summarizing their results
Contextual Projects

• Students own interests are the key
  – Raises the level of interest in assignments

• Students have subject matter knowledge
  – The tasks have meaning for them

• Students have personal interest in topic
  – Probably will reuse the material
  – In their other courses or in real life
Weekly Mini-Projects

• Different project to every group
  – Permits cooperation among students

• Use STARTs and other materials
  – As tutorials and examples for their work
  – Alleviates the instructor from detail work
  – Leaves time for higher level consulting

• Project topics complement each other
  – http://web.cortland.edu/romeu/ecshw.html
Minitab work: Macros

• Learning Stats SW, another course goal
• Preferred software: Minitab
  – Available, easy to learn and use
  – Macros easy to write and execute
• Other software also taught
  – SAS, Excel, examples sent via Email
• Extra Class/Lab to initiate students
Data Analysis/Monte Carlo

• Data collected in class surveys
  – Height, weight, years of experience
  – Nominal, ordinal, interval, ratio

• Monte Carlo generated data
  – For “feeling” about stats distributions
  – For estimation and testing from “known”

• Exercises reinforce/follow curriculum
GPSS work: Programs

- GPSS simulation system (student version)
  - Provided to every student group
  - Just taught how to “run” the programs
- Provides realism (mimics systems)
  - Simulates factory, shop, transportation, etc.
- Allows students & groups to work together
  - Different “seeds” and Performance Measures
Systems Analysis Assignments

• Provides the “big picture” of problems
  – Recognize a problem
  – Define the data required
  – Define the stats procedure
  – Collect and process the data
  – Obtain statistical results
  – Conclude in practical terms
Homework Presentations

• Weekly, all groups are given a HW
  – Power point presentation w/highlights
  – Word document with the explanations

• Students, instructor ask questions to Groups
  – Expand on the subject during presentation

• Students study material constantly
  – Presentations are 20% of their final grades
Support Materials (Readings)

• START sheets are practical tutorials
  – Enough theory to understand background
  – Numerical examples to illustrate it

• Available in the Web Site
  – And also as inexpensive reader

• Used throughout the course
  – STARTs follow the curriculum
  – http://web.syr.edu/~jlromeu/ecschedule.html
The Role of Email/Internet

• Constant access to course Instructor
• Constant contact among group members
• Class materials are all in the Web
  – [http://web.syr.edu/~jlromeu/urlstats.html](http://web.syr.edu/~jlromeu/urlstats.html)
• Weekly assignments, materials, etc.
  – All are sent via the internet (email)
• Student groups work in cyberspace
  – Facilitating easy, fluid interaction
The Final Project

• Contextual: each group chooses topic
  – Many times a real life problem (work)
  – Otherwise, instructor provides GPSS program
• Covers all material given in the course
• Applied: problem-solving approach
• From Problem Statement to Conclusions
  – http://web.syr.edu/~jlromeu/FinProEx.html
• Provides 20% of student Final Grade
Testing and Grading

• Two “Mid Term” tests
  – Three parts each: in-class, group, take-home
  – Individual work (in-class and take-home)
• All tests are open book, open notes
• Take home, long and thought-provoking
• Group work, computer-based
• Each test: 30% of Student’s Final Grade
Examples of GPSS HWs

• GPSS simulation of a job shop
  – Different seed to each group (assigned)

• Different Parameters of Job Shop
  – Input and production rates, buffer sizes, etc.

• Different PM to each group member
  – Throughput, utilization, costs, buffer size, etc.

• Comparison, minimization, optimization
Grading for the Final Project

- 10% Problem Definition
- 10% Statistical problem re-statement
- 10% Data collection/description
- 25% Testing and CI work
- 25% Modeling (regression/ANOVA)
- 10% Statistical/Management Conclusions
- 10% Quality of presentation and material
Conclusions

• A Pleasure to teach and work in
• Work more, but work less …
• Get great student evaluations
• Can cover all course material
• Group presentations, best feature
• Student interest raised and sustained
• Final Project usually excellent