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/ecschedul.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
- 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