USING SIMULATION TO TEACH STATISTICAL LITERACY / STATISTICAL THINKING

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Introduction

- Where Do Statistics Come From?
- Statistical Thinking (Cobb, 1992)
  - has been described as:
    - understanding the need for data,
    - the importance of data production,
    - the omnipresence of variability,
    - and the quantification and explanation of variability
- Simulation and Statistical Literacy / Thinking?

Background at Augsburg College

- Options for Business Administration Majors
  - BUS 379 Intro Statistics for Business and Economics
    - Fairly Traditional Syllabi / Content
  - BUS 264 Statistical Literacy for Managers
    - Combination of traditional statistics and critical thinking skills of Statistical Literacy course
  - GST 200 Quantitative / Statistical Literacy
    - Primary Audience – Students requiring QR Gen Ed skill from "non-quantitative" liberal arts majors

Add'l Augsburg College Background

- General Education Graduation Skills Requirement
  - Starting Fall 2008, New two-tier system
    - QF designation for foundational courses
    - QA designation for application of skills
    - QFA designation for courses which meet both requirements
- Course Project Requirements for QA Designation
  - Student Generated Inquiry
  - Application of foundational quantitative skills
  - Written or oral presentation of results

Potential Dilemma / Solution

- Potential Dilemma:
  - How to satisfy QA requirement with various audiences
  - Course Content and Time Availability
  - No support for two semester sequence
- Proposed Solution:
  - Survey Project with Simulated Data
    - Replace actual data collection with the Use of Computer Simulation / Random Number Generation

Survey Project Components

- Step 1: Written proposal for research topic
- Step 2: Data Collection Plan
  - Define Hypothetical Procedure
  - Write Specific Survey Questions
  - Define parameters for each question
- Step 3: Generate Data via Simulation
- Step 4: Exploratory / Descriptive Statistics Analysis
- Step 5: Inferential Statistics Analysis
- Step 6: Written Executive Summary / Report

End Product – Simulation Program

- MS Excel spreadsheet program with VBA Macros
  - Designed to generate data given student input
  - Student questions must fit template of the assignment
    - Current version for traditional courses
      - 4 Binary Questions
      - 2 Multiple Choice / Likert Questions
      - 2 Continuous Variable Questions
  - Student provided parameters assist in generating "realistic data"

User Input Template

Question	Actual Question	Question Type	Expected Value	Min	Max
One		Binomial		0	1
Two		Binomial		0	1
Three		Binomial		0	1
Four		Binomial		0	1
Five		5-point Likert or Multiple Choice		1	5
Six		5-point Likert or Multiple Choice		1	5
Seven		Continuous			
Eight		Continuous			

Simulation Program Outputs

- Program generates randomly generated sets of responses based on student inputs
- Sample size is pre-determined although it can be easily modified. (Important for significance testing)
- Excel formulas are designed to generate some relationships / correlations between variables.

Benefits of Simulated Survey Projects

- Individualized questions of interest created by students
- Reduction in time to gather actual data
- Increased student motivation through "realistic data"
- Discrete Components allow for instructor feedback in appropriate segments.

Benefits of Simulated Survey Projects

- Elimination of convenience samples
- Focus on Exploratory Data Analysis and communication of results. (Students must learn to "read" what the data are telling them.
- Designed to allow for flexibility in application of various statistical tests.
- Excel Spreadsheet format allows for automation / aid in tabulation of data

Adaptations for Statistical Literacy Course

- Simulated Data provided in tabular format for analysis
- Allows for focus on Social Construction (Assembly)
- Spreadsheet format allows for examination of multiple "definitions" with the same simulated data
- Allows for analysis of confounding

Drawbacks of Simulated Surveys

- Assessment Time for individualized projects
- Rigid Template for Simulated Surveys
- Lack of Data Collection Experience

Further Improvements / Modifications

- More flexible survey template
- Improved correlations between survey variables
- Possible transition into web based application