

Session 5

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What Should We Be 'Teaching' in the Beginning Statistics Course (and When)?

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Should Add: Where and How

Computer Studio Lab

- A "Studio"
- Instructor 1-on-1 (if not)
- Three (or more) students



Meeting Schedule

- 240 Students in class
- One large group meeting (LGM) each week (50 minutes—all 240 students)
- Four lab sections per class (60 students each)
- Each lab section meets two times per week in computer labs

Conduct of Meetings

- Instructor conducts LGM (large group meeting) with 2 TA's and 2 undergraduate interns assisting.
- TA with 1 undergraduate intern meets first computer lab after LGM.
- Instructor meets second computer lab after LGM with 1 TA and 1 undergraduate intern

Goals: Students should be able to

- Understand the reasoning by which findings from sample data can be extended to larger, more general populations.
- Critically evaluate the results of scientific studies
- Design, conduct, and analyze a scientific research study.

Goals (continued)

- Read statistical summaries
 - Analyze data using statistical software
 - Study and understand examples and applications from a variety of fields
 - Learn how to read and apply statistical new techniques
- Are we dreaming? Who's kidding who?**

Learning Assumptions

- Learning is enhanced by collaborative group activities
- Students can learn independently
- There are different kinds of learners (holist, serialist, field dependent and independent, etc.

Technology Assumptions

- Computer labs dedicated to instructional use are available
- Statistical software is available on-line (for example, Minitab, SPSS, SAS, ...)
- Instructors and students can communicate synchronously and asynchronously

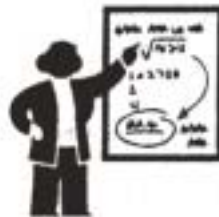
Is he Anti-Computer?



Guiding Principles

- Give responsibility for learning basic concepts to students (and let instructor's role be that of a facilitator)
- Provide as much hands-on work as feasible
- Use technology appropriately
- Reduce time between 'concepts' and 'applications' to a minimum—more on this later.

Professor Lecturing



Readiness Assessment Testing (RATs)

- Students are asked to do pre-assigned readings before coming to class and prior to any instruction on the material.
- Goal: Students are to learn some of the basic concepts of the course on their own.
- Reading assignments cover a unit or major topic of instruction (a 'module')

Readiness Assessment Tests (Otherwise Known as RATs)

- Individual
- Group
- Appeal



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RATs Procedure

Students

- take individual test with multiple choice and true/false items on assigned readings
- take a 'Group Rat Test' on same quiz.
- can appeal (as a group) incorrect answers
- are given immediate feedback by instructor

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Goals of RATs

- Individual: ensure individual accountability and understanding of general concepts and principles rather than small, detailed facts.
- Group: help individual members of the group comprehend ideas that they may not have gotten on their own.
- Appeals: help members understand why their answers were incorrect

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Instructor Use of RATs

- to determine where students still have misconceptions or misunderstandings.
- to provide feedback to students on concepts that students are having troubles with.
- enables instructor to focus instruction and activities on application of the course content rather than spending time covering topics easily understood on their own.

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Consequences of Using RATs

- Time devoted to learning basic concepts is more efficiently used: less time on easier concepts and more on harder concepts
- Students are well prepared for applications in the computer labs.
- Students become accustomed to learning concepts on their own, enabling greater flexibility in sequencing of topics

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Student Reactions to RATs

- They prefer studying on their own to sitting through lectures (are you surprised at this?)
- Their performance on RATs is much better than you would ever guess!
- They like having to keep up with course on a regular basis

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Recommended Reading (Handouts)

1. Readiness Assessment Process
2. Step-by-Step Outline of the RAT Process
3. Effective Assessment: Using Small Groups to Improve the Quality of Learning in Higher Education
4. Article by Larry K. Michaelsen: Myths and Methods in Successful Small Group Work

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Course Materials

- printed text (we are using a draft of a book authored by Jessica Utts and Bob Heckard that will be published in the Spring 2001)
- web course—Cyberstats—available on-line in the Spring 2000 and undergoing revision for Fall 2000
- special readings prepared by instructors

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Cyberstats Courseware



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Individual/Group Work in Computer Labs

- In first lab after the RAT, lead by a TA, students work alone or in pairs (a 'Dyad') and quiz is given at end of lab on the activities done.
- In second lab, lead by instructor; activities are done by groups of four, and are more challenging. A group quiz is given at end of lab on the activities done.

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Lab Activities

- Focus on application of concepts covered by RAT
- Activities in the first lab after RAT, led by TA, are moderately structured, to reinforce learning of the concepts at a basic level
- Activities in the second lab after RAT, led by instructor, are more unstructured and require a higher level of analysis.

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Prior Views on Sequencing

Why have most texts generally adopted the same sequencing of topics?

Moore and McCabe View: Puzzle with three pieces:

- i. Describing data
- ii. Producing data (designs, probability)
- iii. Inference

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Sequencing of Topics: Overview

- Introduce inference early (within the first two weeks)
- Whenever appropriate, include inference with new topics as you go—for example, in covering descriptive statistics, using a case study, specify null and alternative hypotheses, obtain p-value and make decision

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Sequencing of topics: Overview (Continued)

- Build on topics previously covered by adding new bells and whistles, while reinforcing them over and over again.
- Keep applications closely tied to new concepts—don't say "you'll understand why we are doing this six weeks from now!"
- Be careful not to use concepts not needed for course unless there is a good reason.

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Sequencing of Topics by Week

- Week 1: Course Overview; Data: Types of Variables; Descriptive Statistics for Categorical Variables
- Week 2: Basic Concepts of Inference: Margin of Error and Confidence Intervals; Hypotheses; Making Decisions; Types of Errors; Probabilities of Errors; P-value

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Sequencing of Topics (continued)

- Week 3: Describing Numerical Data, Interwoven with Inference
- Week 4: RV's, Probability Distributions; Expected Values; Binomial and Normal Distributions; Inference for the Median
- Week 5: Sampling Distributions, in General and for Means and Proportions; T-Distribution

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Sequencing of Topics (continued)

- Week 6: Inference for One Mean and One Proportion
- Week 7: Surveys, Experiments, Types of Studies
- Week 8: Project Work; Review for Midterm
- Week 9: Project Work on Surveys, Types of Studies, and Experiments.

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Project 1

- Design a Good Poll
- Design a Bad Poll
- Design an Experiment

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See Handout on Project 1

- Students will need to find examples of good polls and bad polls, on the web, based on their readings of the course materials.
- Clues are given on where to look for good and bad examples.
- Students will be asked to design a randomized experiment (with 2 treatments or more)

Sequencing of Topics (continued)

- Week 10: Inference for Two Means, Two Proportions, and Paired Comparisons
- Week 11: Correlation and Regression
- Week 12: Project Work
- Week 13: Chi-Square Tests; 1 Factor AOV
- Week 14: Selection of Statistical Procedures
- Week 15: Review for Final Exam; Wrap-Up

Project 2

- Major Study Involving:
Creating a Survey (on Music)
Students Filling Out Survey
Analyzing Survey Responses, Using at Least 4 or 5 Statistical Techniques
Synthesizing Semester Topics
Writing a summary Report

See Handout on Project 2

- Students will need to determine whether to use mean or median as measure of location
- They will need to read about nonparametric tests and to use appropriate one if the median is used.
- Nonparametric inference, except for the sign test, is not covered in course. But through RATs they should be prepared!

Some Closing Comments: I

- It is easy to list the set of topics one will select to choose from to include in the course. It is not so easy to make careful final decisions on coverage.
- Free yourself of preconceived notions on the order in which you think topics ought to be covered. Then assemble a sequence that you think meets your course goals.