

Assessing Statistical Learning

SOCR/CAUSE UCLA 2007

GAISE

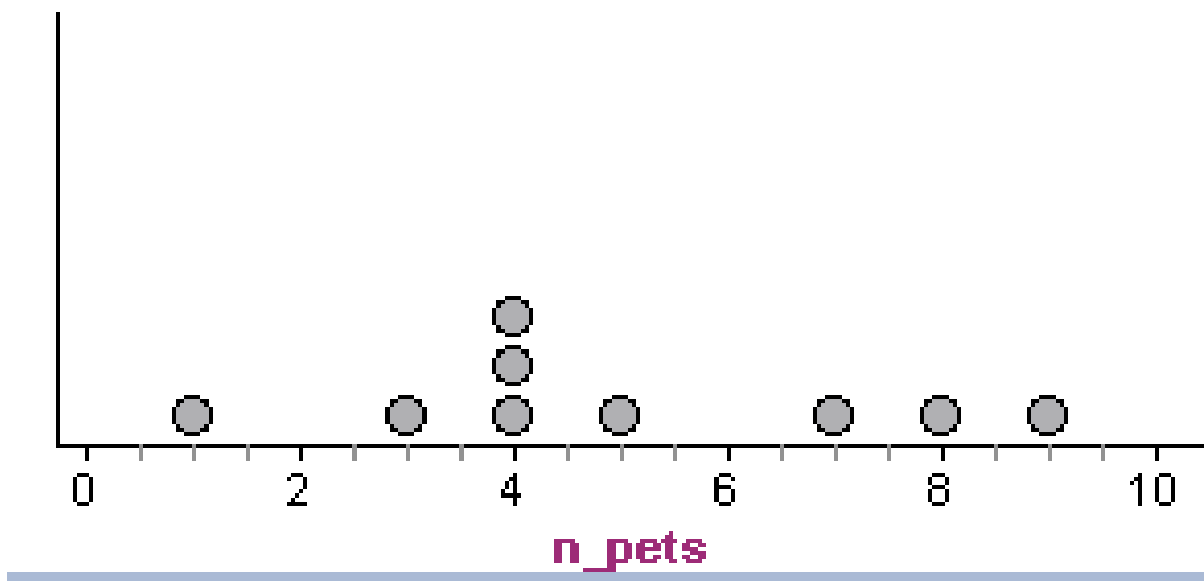
- Guidelines for Assessment and Instruction in Statistics Education College Report ratified by ASA in 2006.
- <http://www.amstat.org/education/gaise/>

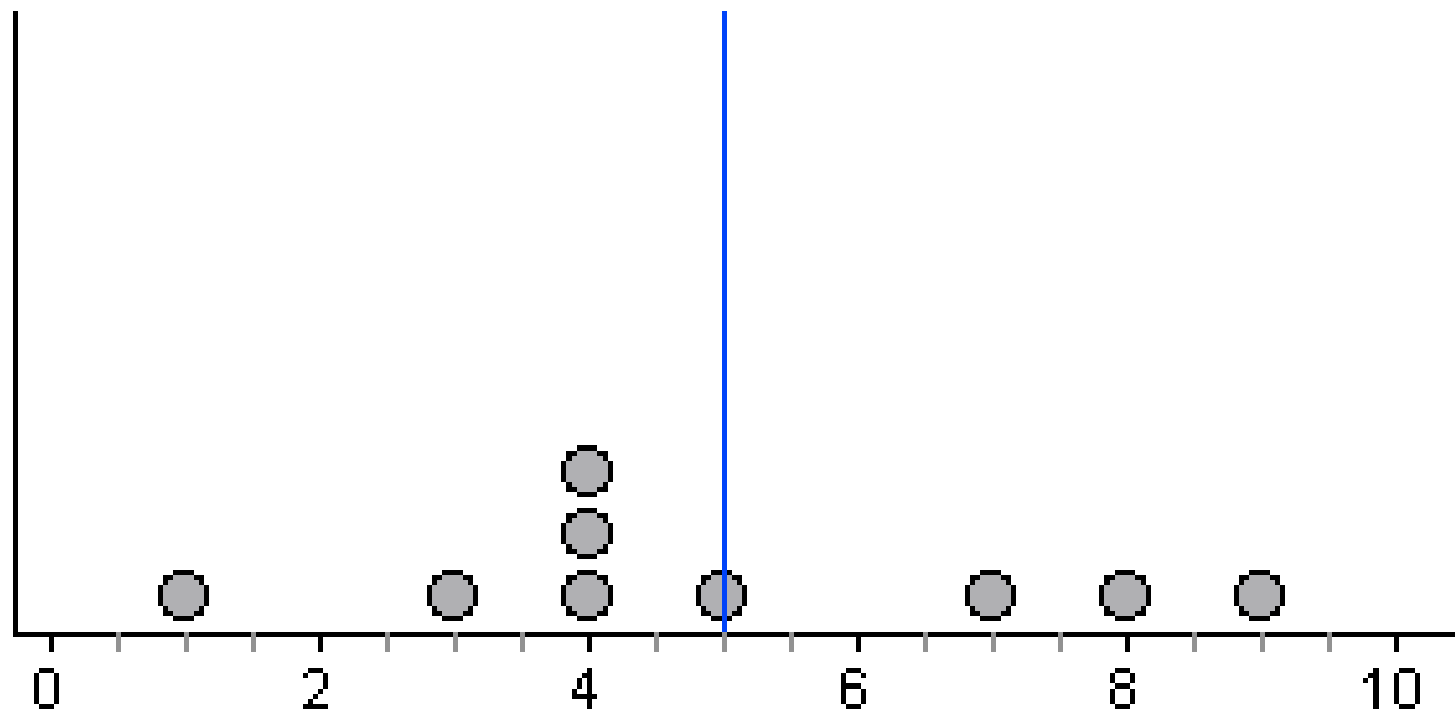
Six recommendations

- Emphasize statistical literacy and develop statistical thinking
- Use real data
- *Stress conceptual understanding rather than mere knowledge of procedures*
- Foster active learning in the classroom
- Use technology for developing conceptual understanding and analyzing data
- *Use assessments to improve and evaluate student learning*

What's an example of a statistical concept?

- The next dotplot shows the number of pets owned by children in a small class.
- What's the mean number of pets? You'll have 3 seconds to examine the dotplot.





n_pets

mean() = 5

Goals are two-fold

- Introduce you to an example of an assessment of statistical concepts
- Provide some understanding of what a statistical concept is through examining the assessment items

Comprehensive Assessment of Outcomes in Statistics

- https://app.gen.umn.edu/artist/research_instruments.html
- Also via www.causeweb.org : research: getting started: assessment tools
- Garfield, DelMas, Chance

Validity

- Examined by 18 expert raters who had high agreement that the exam tested important basic learning outcomes
- Internal consistency based on testing 1028 students (Cronbach alpha 0.77)

Description

- 40 items that focus on reasoning with and about variability (which was identified as the major theme of a first course.)
- Takes about 50 minutes
- A shorter (14 item) test also available, which we'll take now! Called the START exam.

- Does your textbook prepare students to do well on this exam?
- Do your homework assignments prepare students to do well on this exam?
- Are there questions you think should be removed?
- Are there topics you'd like to see included?

What is hard?

(less than 50% correct on post test and no gain from pre test)

- Understanding the purpose of randomization in an experiment
- Understanding that boxplots do not provide accurate estimates for percentages of data beyond the quartiles
- Judging standard deviations from histograms
- Understanding expected patterns in sampling variability
- correlation does not imply causation

Hard stuff...

- Ability to detect a type of misinterpretation of a confidence level (the % of sample data between confidence limits, % of all sample means between conf. limits)
- How sampling error is used to make informal inferences about mean
- Median $>$ mean suggests distribution skewed left

More hard stuff...

- Understanding how to select an appropriate sampling distribution for a particular population and sample size.
- Understanding how to calculate appropriate ratios to find conditional probabilities from a table of data
- How to simulate data to find a probability
- When it is not wise to extrapolate using a regression model

Easy stuff

(High percent of correct responses on both pre and post test)

- describe and interpret overall distribution as displayed in a histogram, referring to context of the data
- Comparing groups by considering where most of the data are; focusing on distributions as single entities
- Compare groups by compare differences in averages
- Groups do not need equal sample sizes for valid comparisons.

More easy

- meaning of variability in context of repeated measurements
- Match a scatterplot to a verbal description of a bivariate relationship
- Correctly describe a bivariate relationship shown in a scatterplot when there's an outlier
- Understanding that no statistical significance does not guarantee that there is no effect

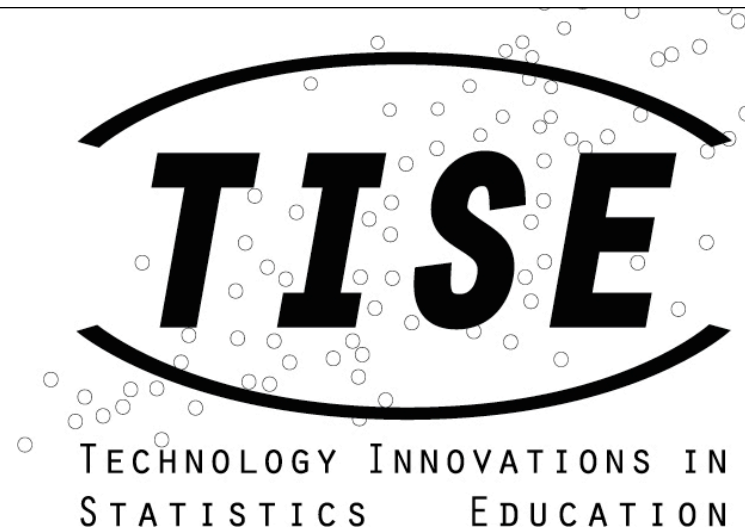
References & Resources

- “Assessing students’ conceptual understanding after a first course in statistics”, DelMas, Garfield, Ooms, Chance, accepted for publication in SERJ.
- CAUSEWEB
- ARTIST site

Technology Innovations in Statistics Education

Volume I appearing Fall 07

- George Cobb, “The Introductory Statistics Course: A Ptolemaic Curriculum?”
- Chance, Ben-Zvi, Garfield, Medina, “The Role of Technology in Improving Student Learning in Statistics”
- Daniel Kaplan, “Computing and Introductory Statistics”
- Dani Ben-Zvi, “Using Wiki to Promote Collaborative Learning in Statistics Education”
- Finzer, Erickson, Swenson, Litwin, “Data Into the Classroom”



- Not just intro stats, but K-12, college, graduate, professional
- Visit <http://tise.stat.ucla.edu> to be notified when first issue appears (Fall 07), submit a manuscript, learn more