Teaching the Social Construction of Statistics

MILO SCHIELD
Augsburg College
Director, W. M. Keck Statistical Literacy Project
www.StatLit.org Schield@augsburg.edu

Midwest Sociological Society

Chicago, IL, 6 April, 2007
Slides: www.StatLit.org/pdf/2007SchieldMSS4Up.pdf
Paper: www.StatLit.org/pdf/2007SchieldMSS.pdf

Statistics: Rocks or Diamonds

People realize that houses, cars, books, poems, plays and songs could have been made differently.

Yet people think of statistics as pure numbers.

But reality isn't pure.

People aren't easily classified as rich or poor. Families aren't easily classified as dysfunctional. Deaths aren't easily classified as suicides, as heat-wave deaths, or as due to second-hand smoke.

All Statistics are Socially Constructed

Joel Best (2001, 2002) has argued that:

- *"all statistics are socially constructed."*
- *"statistics are like jewels; they have to be selected, cut, polished, and be placed in settings…".*
- *Statistics instruction needs to address this social process. It needs to concern itself with matters of construction – as well as calculation"*

Social Construction: Measurable Effects

Given the underlying data, one can calculate some influences of this social construction:

- choice of mean versus median
- choice to focus on selected sub-group.
- choice of how to group subgroups
- choice to include/exclude outliers,
- choice of what cutoff to use in forming groups
- choice of P(A|B) versus P(B|A)

6 April 2007 MSS 5

Social Construction: Un-measurable Effects

Even with all data, some effects are unknown

- sampling bias in random sampling
- non-response, respondent or researcher bias
- measurement bias (changing question)
- changing the target/sampled population
- changing the sample size
- changing the definition of a group or measure embedded in the original data
- including a plausible confounder

6 April 2007 MSS 6

Social Construction: Greatest in the Media

The less data available, the less that can be known about the effects of social construction.

Media stories typically present only a few carefully-selected summary statistics so

- the influence of social construction on these statistics is unknown and unknowable.
- readers must be most careful in drawing conclusions from such summaries.

6 April 2007 MSS 7

Hypothetical Thinking

Evaluating statistics requires hypothetical thinking on how the statistics could have been constructed.

This focus on context

- links statistical literacy with the liberal arts
- links statistical literacy with critical thinking
- links statistical literacy with inductive reasoning
- takes statistical literacy beyond traditional math

6 April 2007 MSS 8

Hypothetical Thinking: The Challenge

How can students be taught:

- to see that all statistics are socially constructed?
- to think hypothetically about alternatives?

How can student be taught to distinguish:

- between plausible and arbitrary?
- between material and trivial?

Hypothetical Thinking: More Problems

Students lack training in hypothetical thinking:

- estimating magnitudes or ranges
- estimating associations or correlations
- comparing the influence of different factors
- distinguishing between plausible and arbitrary.

Teaching Hypothetical Thinking

To develop skills in hypothetical thinking, students must practice in calculating the influence of small changes in factors that are known.

Students need drill with factual questions to practice deductive thinking:

1. Influence of choices on numeric answers
2. Influence of choices on math-related ideas.
3. Influence of choice of study design on factors that could influence statistics

Deductive Thinking: 1a: Numeric Answer

Students need arithmetic problems that measure the influence of social construction.

- How does the choice of a basis for comparison influence the size of the comparison?
- How does the definition of a group or measure influence the average, standard deviation, Z-score and effect size?
- How does taking into account the influence of a related factor change the size of an association?

Deductive Thinking 1b: Correct Answer

Students need drill on factual questions that have a single non-numeric answer.

- Which definition gives the larger count or rate?
- Which choice of comparison gives bigger #?
- Which choice of part & whole gives bigger %?
  percentage of male smokers who are runners
  vs. percentage of smokers who are male runners

6 April 2007 MSS 13

Deductive Thinking 2: Ordinary English

Small changes in syntax can create big changes in semantics

- Compare numbers (arithmetic):
  6% is 50% (2 percentage points) more than 4%.
  8 is 300% (3 times) more than 2.
- Describe and compare (ordinary English):
  Gun deaths *each year* doubled in the last 50 yrs.
  Gun deaths doubled *each year* in the last 50 yrs.

6 April 2007 MSS 14

Deductive Thinking #3: Non-Math

Different contexts – different study designs -- determine what factors can influence a statistic.

What kinds of alternates are eliminated by

- studies being experiments vs. observational?
- studies being controlled vs. uncontrolled?
- studies being longitudinal vs. cross-sectional?
- outcomes being counts vs. ratios?

6 April 2007 MSS 15

QL and NNN: A Choice

These must be part of quantitative literacy!

1. All statistics are socially constructed.
2. This social construction influences the size of a statistic or of an arithmetic association.
3. Analyzing and evaluating the social construction of a statistic often requires hypothetical thinking.
4. Students need exercises showing how small changes in construction can yield big changes in numbers, rates or percentages. Schield (2007).

6 April 2007 MSS 16

References

Best, Joel (2001). *Damned Lies and Statistics*

Best, Joel (2002). Paper presented at JSM of ASA. Copy at www.StatLit.org/pdf/2002BestASA.pdf.

Schield, Milo (2007). *Statistical Literacy: Factual Assessment.* International Assoc. of Statistical Educators Portugal. www.StatLit.org/pdf/2007SchieldIASE.pdf.