Statistical Literacy and the Common Core Curriculum in the United States

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These are interesting time for K-12 statistics education in the U.S.

Something is coming, but the BIG question is

Is it a tsunami

or great wave the we can catch and ride??

A Bit of History…

- Statistics has been a recommended part of the high school mathematics curriculum for a LONG time.
  - *Curriculum and Evaluation Standards* (NCTM, 1989), Standard 10
  - *Principles & Standards for School Mathematics* (NCTM, 2000), Data Analysis and Probability Standard

A Bit of History...continued

BUT...

- Impact? Not so much.
- Implementation has been elusive.
- Where statistics has been incorporated, it has often been done in an ad hoc way.
- All things considered, disappointing and little impact.

A Bit of History...continued

So what has changed?

Common Core State Standards in Mathematics.

Statistics standard gives statistics a more prominent role and places much more emphasis on conceptual understanding.

So, if NCTM standards didn't have widespread impact, what makes us think even more aggressive statistics standards will have any impact?

- It's POLITICAL!
- Initiated by State Governors' Association and Chief State School Officers.
- Currently 42 states have committed to CCSS.
- NATIONAL assessments are being developed.

Where Does This Leave Us?

- HUGE opportunities!
- HUGE challenges!

Huge Opportunities…

- The standards
  - Carry the promise of “statistical literacy for all.”
- The college-level introductory statistics course
  - Opportunity to completely re-think the college intro stat course.

The Standards

Summarize, represent, and interpret data on a single count or measurement variable

S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

The Standards – There's More!

Summarize, represent, and interpret data on two categorical and quantitative variables

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

- a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
- b. Informally assess the fit of a function by plotting and analyzing residuals.
- c. Fit a linear function for a scatter plot that suggests a linear association.

The Standards – And More!

Interpret linear models

S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9. Distinguish between correlation and causation.

The Standards – But Wait! There's Even More!

Make inferences and justify conclusions from sample surveys, experiments, and observational studies

S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

S-IC.6. Evaluate reports based on data.

Wow!

This is not a description of the Advanced Placement or college-level statistics course! This is what ALL students are expected to have mastered by the time that they leave high school.

The College Intro Statistics Course

- What would you do if students came into your course with this background??
- Would it be what you are doing today?

Huge Challenges...

- The standards
  - Every Algebra I and Algebra II teacher now has dual role of teacher of mathematics AND teacher of statistics. Will algebra teachers be prepared for this?
- The college-level introductory statistics course
  - Colleges are notoriously slow to change. Enough said!

What Needs to Happen for “Statistical Literacy for All” to be More than a Pipe Dream?

- Curriculum reform (major)
- Teacher professional development
- GOOD ASSESSMENTS

Why I Am Nervous...

- Not sure that publishers fully understand the standards.
- Every algebra teacher?? And not just teaching statistics at a computational level, but at a conceptual level.
- Good assessments are critical—success will hinge on this.

A Call to Action!

- Statistics community can't just keep fingers crossed and watch from the sidelines.

- Need to be proactive, especially with respect to teacher professional development—both in-service and pre-service.

  If we miss this opportunity, it may not come again for a LONG time!