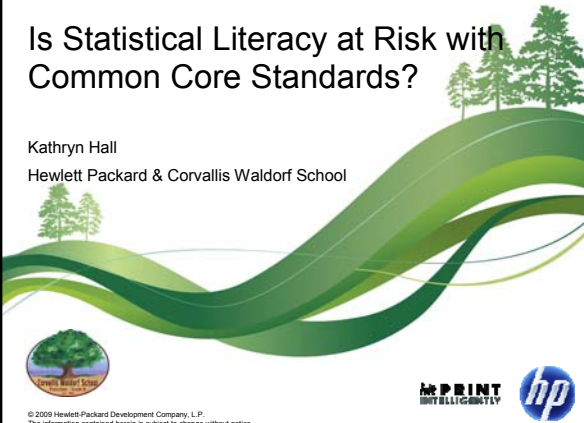



Is Statistical Literacy at Risk with Common Core Standards?

Kathryn Hall
Hewlett Packard & Corvallis Waldorf School

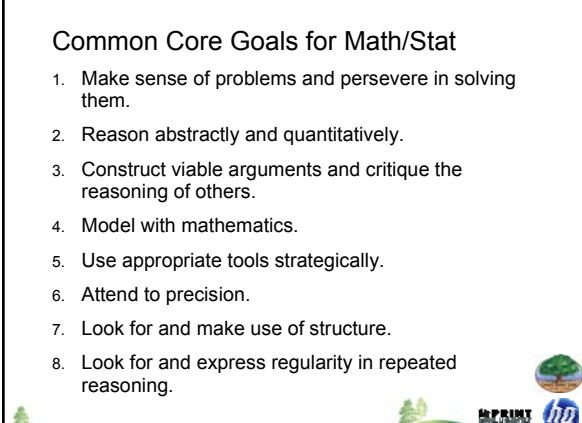



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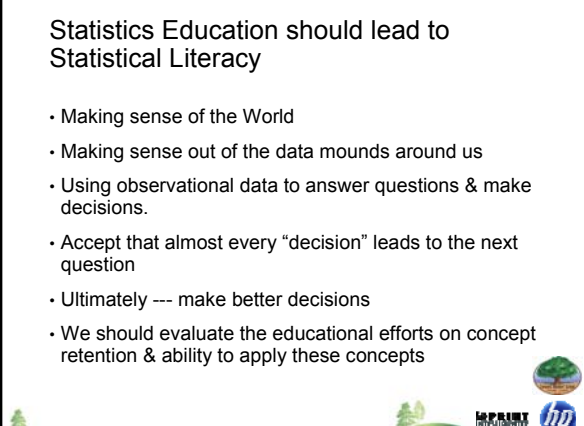

Common Core Goals for Math/Stat

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

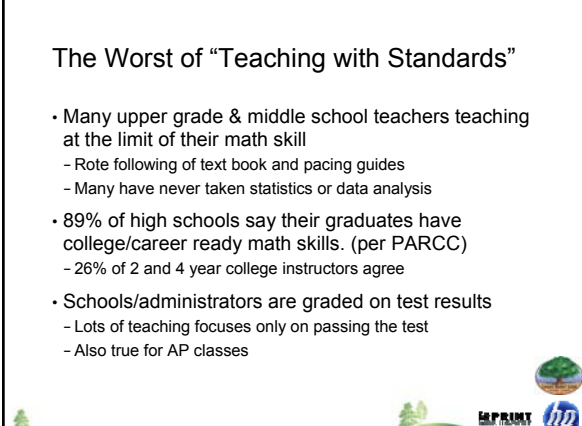

Statistics Education should lead to Statistical Literacy

- Making sense of the World
- Making sense out of the data mounds around us
- Using observational data to answer questions & make decisions.
- Accept that almost every "decision" leads to the next question
- Ultimately --- make better decisions
- We should evaluate the educational efforts on concept retention & ability to apply these concepts

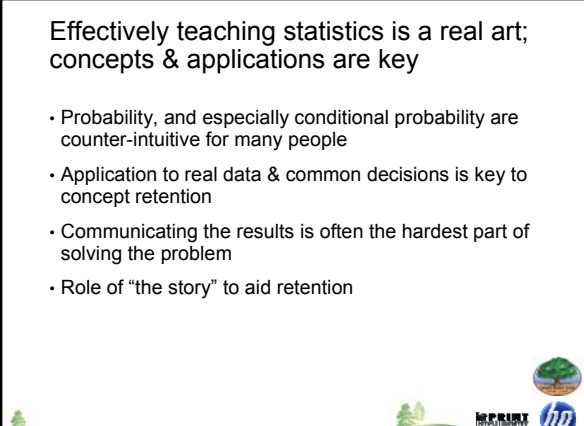

The Worst of "Teaching with Standards"

- Many upper grade & middle school teachers teaching at the limit of their math skill
 - Rote following of text book and pacing guides
 - Many have never taken statistics or data analysis
- 89% of high schools say their graduates have college/career ready math skills. (per PARCC)
 - 26% of 2 and 4 year college instructors agree
- Schools/administrators are graded on test results
 - Lots of teaching focuses only on passing the test
 - Also true for AP classes

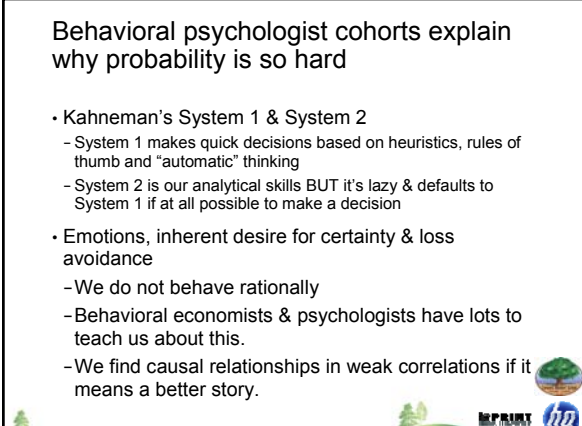

Effectively teaching statistics is a real art; concepts & applications are key

- Probability, and especially conditional probability are counter-intuitive for many people
- Application to real data & common decisions is key to concept retention
- Communicating the results is often the hardest part of solving the problem
- Role of "the story" to aid retention

Behavioral psychologist cohorts explain why probability is so hard

- Kahneman's System 1 & System 2
 - System 1 makes quick decisions based on heuristics, rules of thumb and "automatic" thinking
 - System 2 is our analytical skills BUT it's lazy & defaults to System 1 if at all possible to make a decision
- Emotions, inherent desire for certainty & loss avoidance
 - We do not behave rationally
 - Behavioral economists & psychologists have lots to teach us about this.
 - We find causal relationships in weak correlations if it means a better story.

Integrated Learning Provides plenty of Stories that will be Remembered

- Difficulty in traditional university “silos”
 - Leads to other departments teaching their own statistics classes
- University examples of effective integration exist
 - St. Olaf College Winter interim project
 - U. de Concepcion capstone project with cancer data set



Effectively communicate analysis results

- This is often the most difficult part of the entire project
 - Make use of System 1 & System 2 in how you present your results
 - Tufte's books help teach effective communication
 - St. Olaf project spent 25% of course time on preparing the communication to the decision makers
- ASA & ISLP Poster contests
- Writers are more aware of this than most statisticians
 - This is another great way to cover multiple CC standards at once



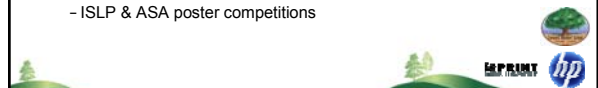
Statistics - Part of the Math Standards

- Focus is very much on probability theory & formal test statistics
- Improving Use of Data to Solve Real Problems
- Excellent discussion in May *Amstat News* by Christine Franklin



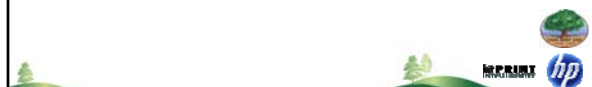
Need Extensive interaction with Math Education Professors & State Ed. Dept.

- Math educators must appreciate how statistics are the same & different than math
- Work to provide teacher education & professional development activities for statistics
- Help create and provide integrated learning methods
- Familiarize math teachers with ASA resources
 - GAISE report
 - “Making Sense of Statistical Studies”
 - Census at School
 - ISLP & ASA poster competitions



Ultimate goal: Apply the skills to Real Problems

- Presentation methods have a huge impact on the decision selected
 - Chose presentation style that increases the chance of the right decision
 - Tell a good story
- Expect human irrationalities to impact decisions
- If the analysis is too complex or incomprehensible, it is rejected
 - People revert to System 1



Statistical Literacy Requires

- Good teaching: Relevant and Rigorous
- Connected to applications students finds interesting
- Taught by someone with statistical and mathematical depth and breadth
- All this will not happen until skilled statisticians who care about K-12 learning actively get involved



