Cat image *via Shutterstock*

Statistics & Education

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From Ann Landers to Education…

- "Recall the Ann Landers column (23 January, 1976) that reported the results of a reader write-in survey: 70% of parents say "Kids not worth it" -- if they could do it over again."

- "Even more surprising, the longer the fall, the greater the chance of survival. Only one of 22 cats that plunged from above 7 stories died, and there was only one fracture among the 13 that fell more than 9 stories." *www.cut-the-knot.org/do_you_know/misuse.shtml*

- … "high kindergarten scores predicted a wide variety of outcomes for the students: They were more likely to attend college, have retirement savings, be homeowners, and live in better neighborhoods." Wilson, 2012

"NO OFFENSE, MISS MYERS, BUT THIS 'ALGEBRA' IDEA OF YOURS IS *NEVER* GOING TO CATCH ON!"

Images for **cartoons about algebra math**

"Key to college success is eighth grade algebra"

"Algebra II: leading predictor of college and work success"

"…students who had taken Algebra II in high school were twice as likely to earn a bachelor's degree as students who had not taken this course but had also enrolled in college (Adelman 2006)."

Making decisions based on data

- The conditions under which data are collected are important in drawing conclusions from the data; in critically reviewing uses of statistics in public media and other reports, it is important to consider the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

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CCSS, 2010 HS

"My daughter did not succeed in that book; with that teacher, in that school…."
"That is not how I learned….."

Using Data to Inform Instruction.. : A Continuous Improvement Framework

Advances in technology now provide invaluable resources and tools for educators at all levels. These tools—and the data they provide—can be harnessed by educators to inform daily instructional practices to increase academic rigor and growth, enabling students of all abilities to enjoy learning, unlock their potential, and achieve proficiency. … See how data from multiple measures of assessment are used to make informed decisions, assign personalized content with instantaneous feedback, identify instructional interventions, and help educators to create a personalized learning environment for all students.

Data-Driven Innovations Consulting, Inc.
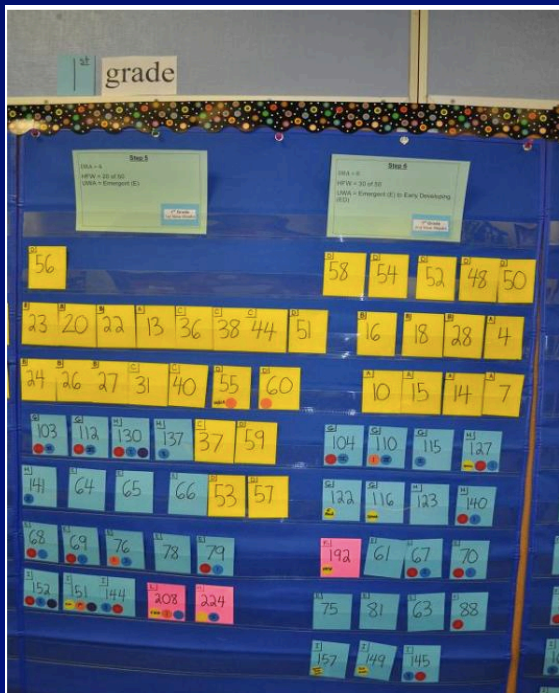
"We are completely data driven"

- "Guidelines for data walls - Connecticut State Department of Education"

- "CSD1 data wall encourages student success"

Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability.
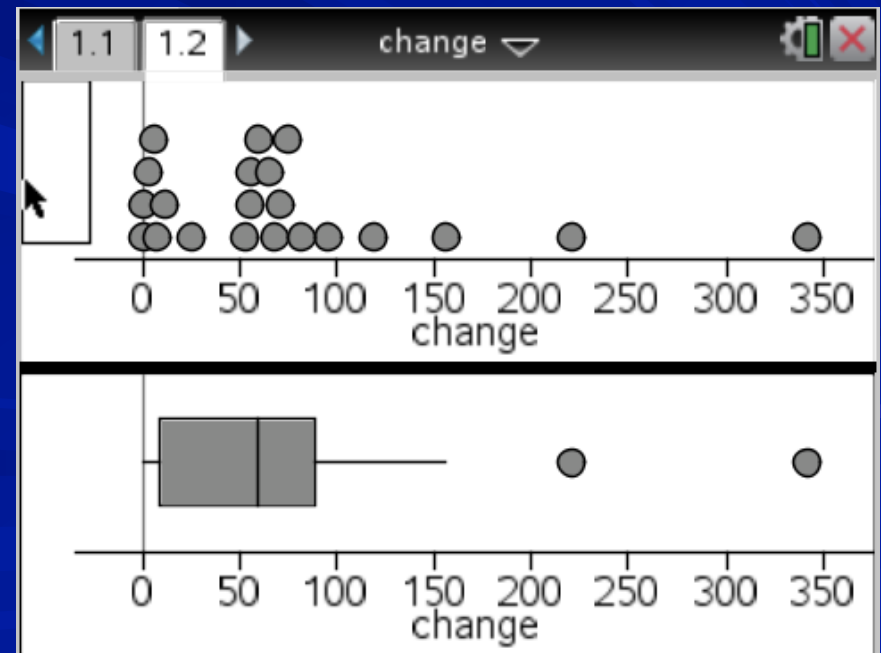
CCSS, 2010
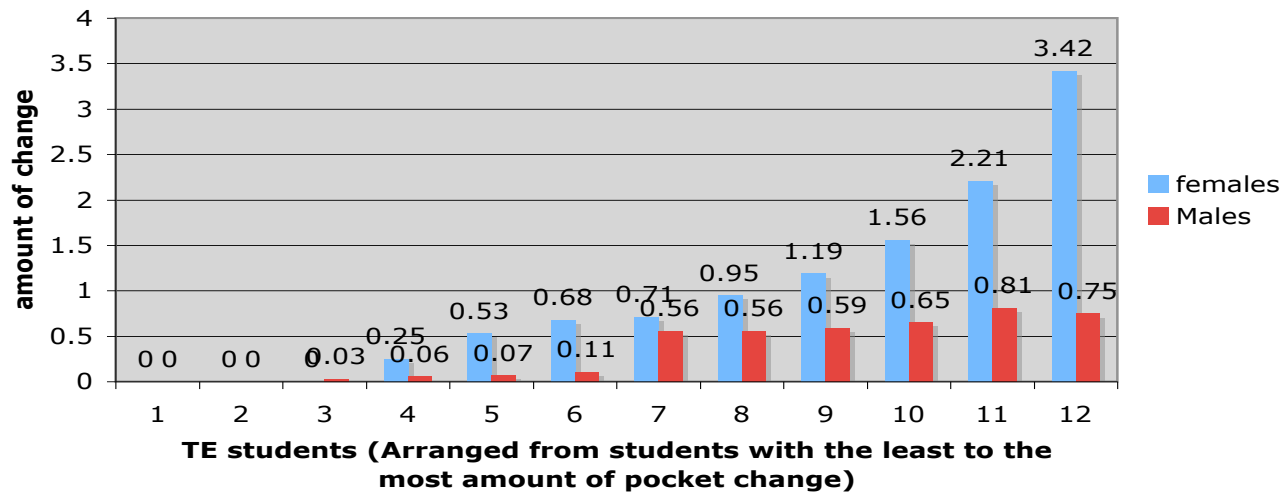
Statistics is not about individuals
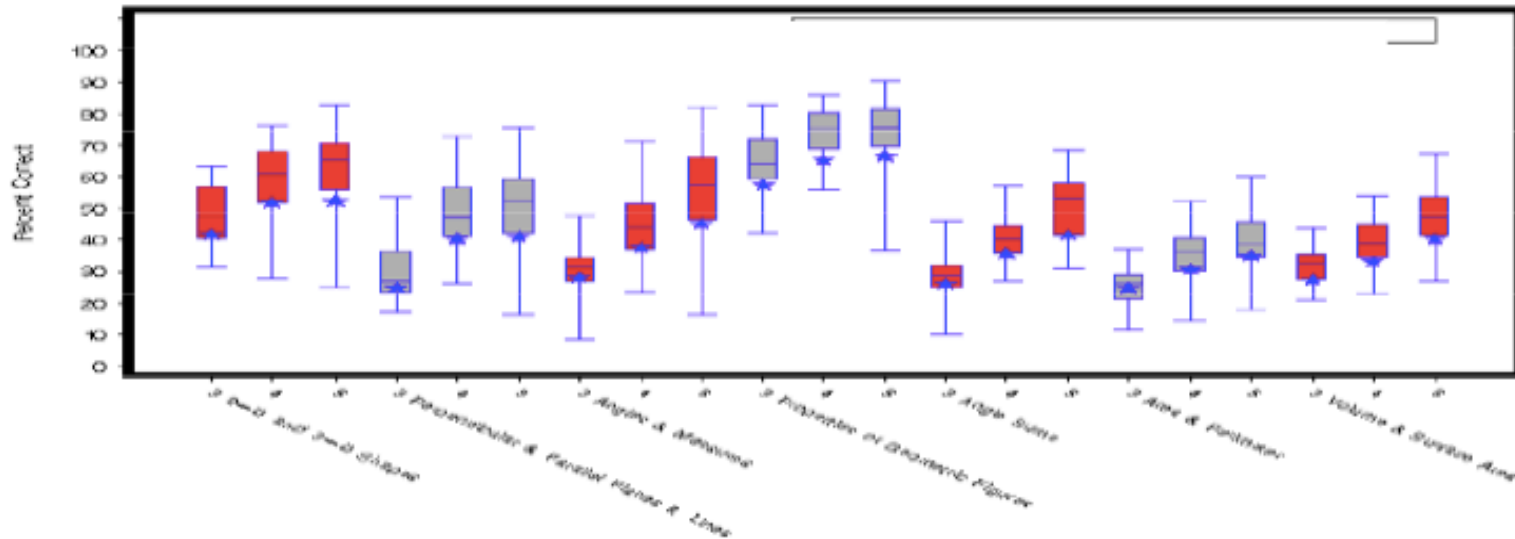
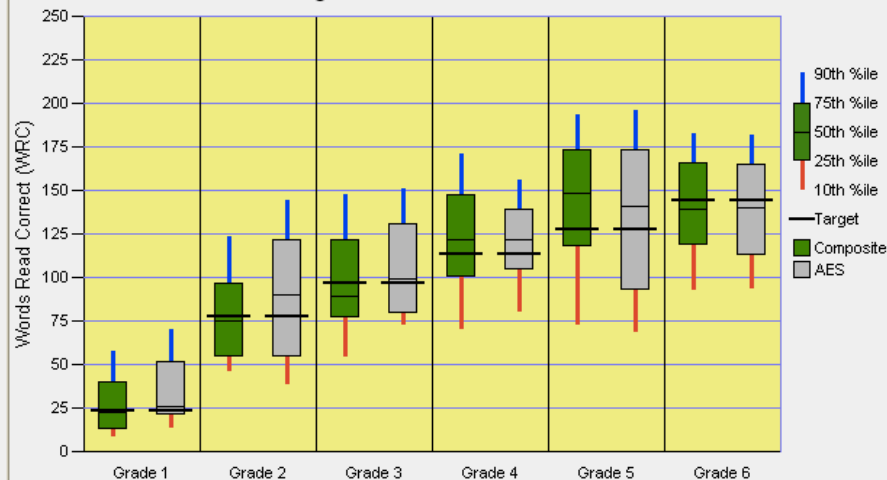Statistics is about trends and summarizing group behavior to better understand and make decisions.

Display 16. Boxplots of Average Percent Correct on Select PROM/SE Elementary Mathematics Strands (Set 3) for All PROM/SE Districts at Each Grade
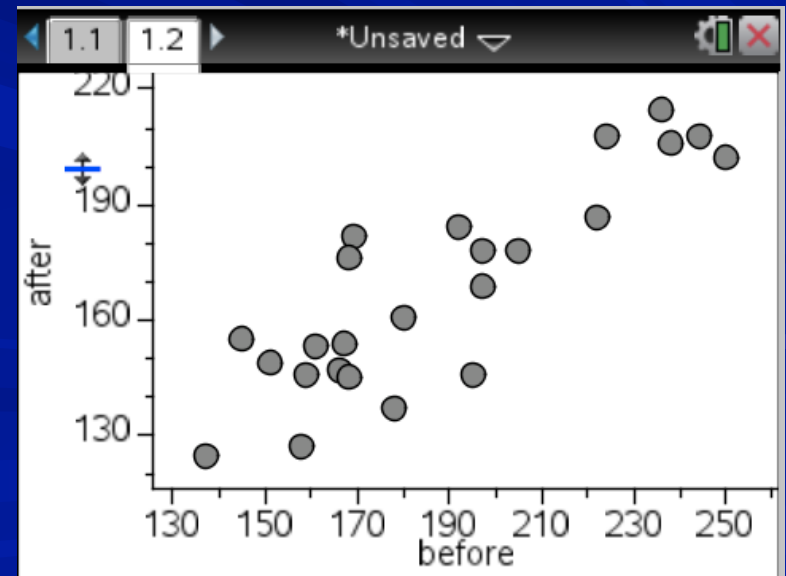
Geometric Concepts by Grades

School Comparative Performance

Statistics is about interpreting variability in data

Cholesterol Levels Before & After Treatment


Statistics is not about individuals.

- Before
- After

Statistics is about patterns, trends, and making predictions

Statistics in the CCSS

- Develop the tools to analyze a set of data
- Experience randomness and begin to understand the consistency involved in random events
- Investigate what is meant by a normal curve
- Reason from a two-way table involving categorical data
- Compare an observed outcome to what would be expected by chance- making inferences
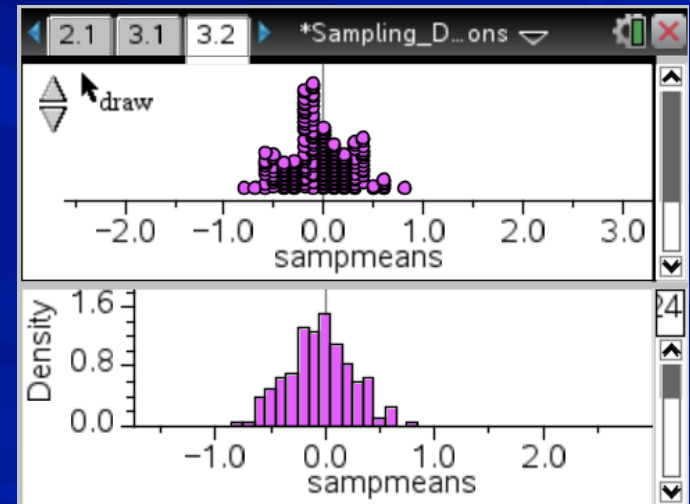
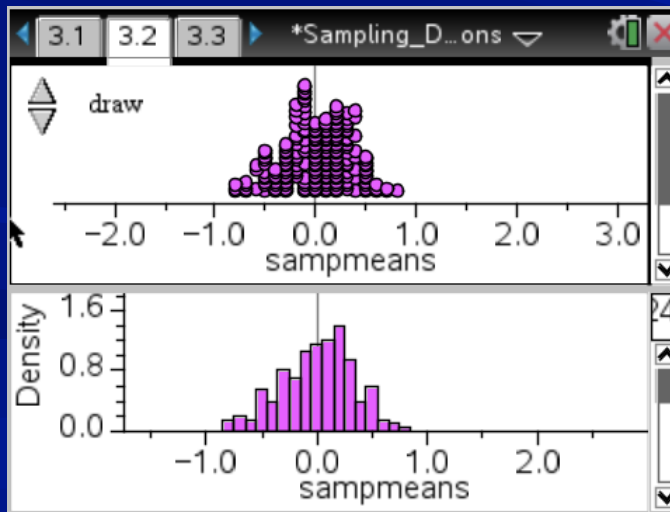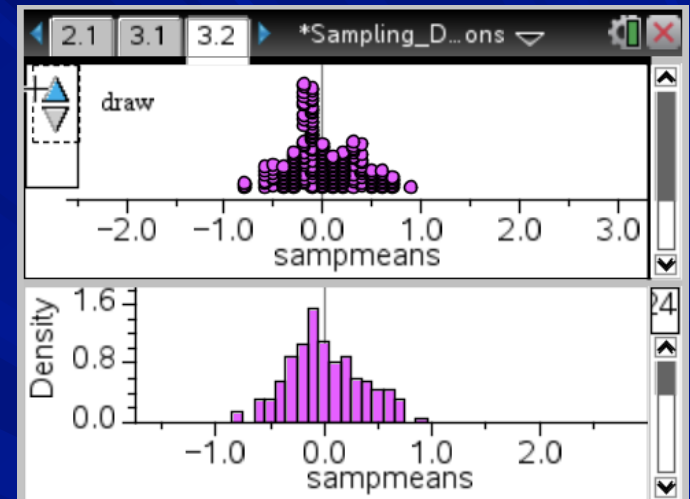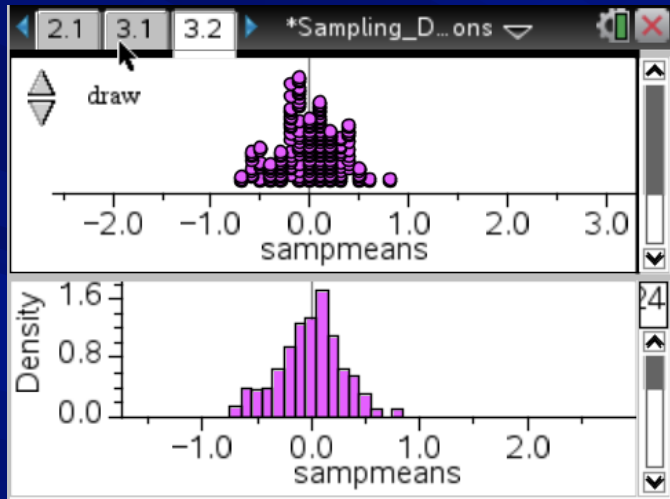# Not everything is normal
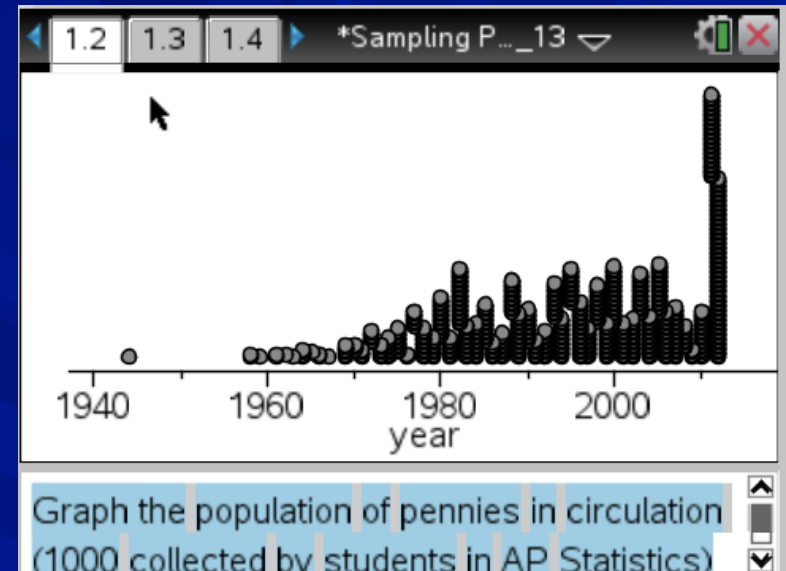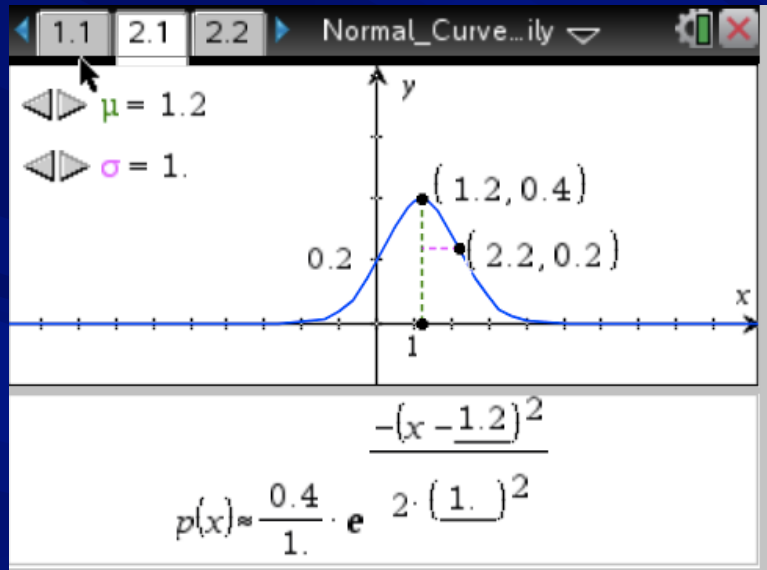
Ruth Carver, 2013
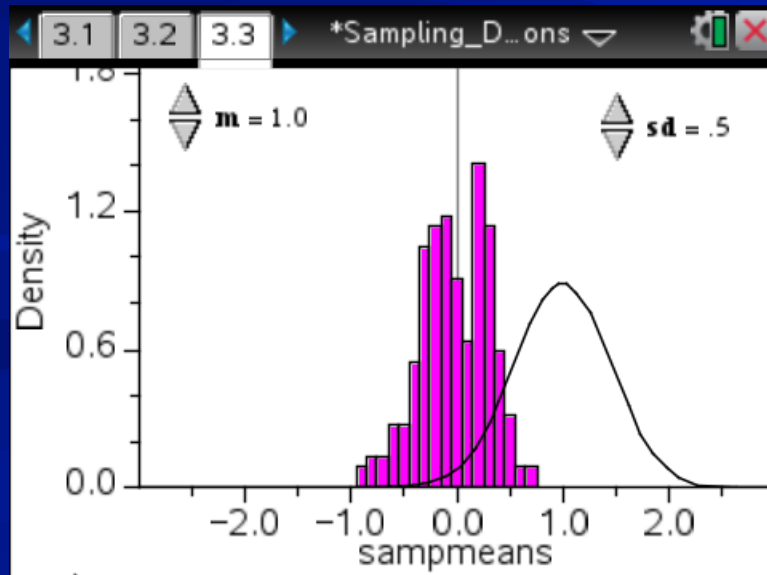
Theoretical distributions allow us to reason against a backdrop
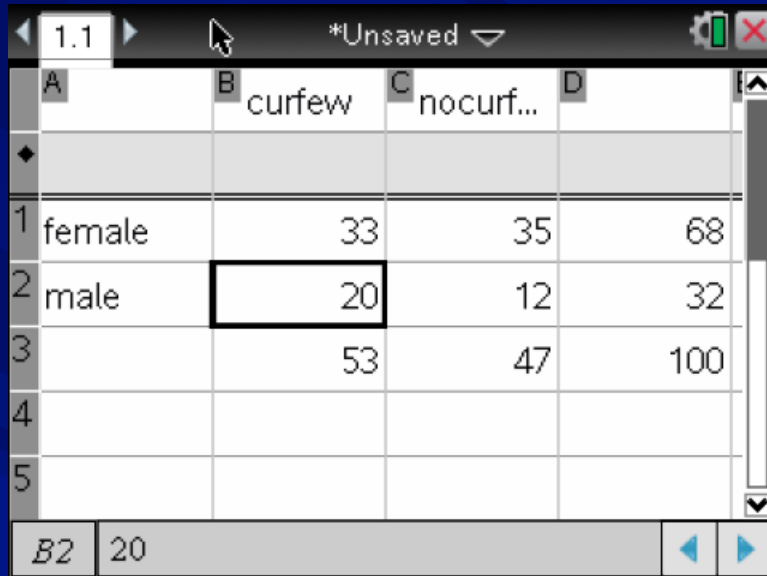
Randomness is central

Curfew vs gender

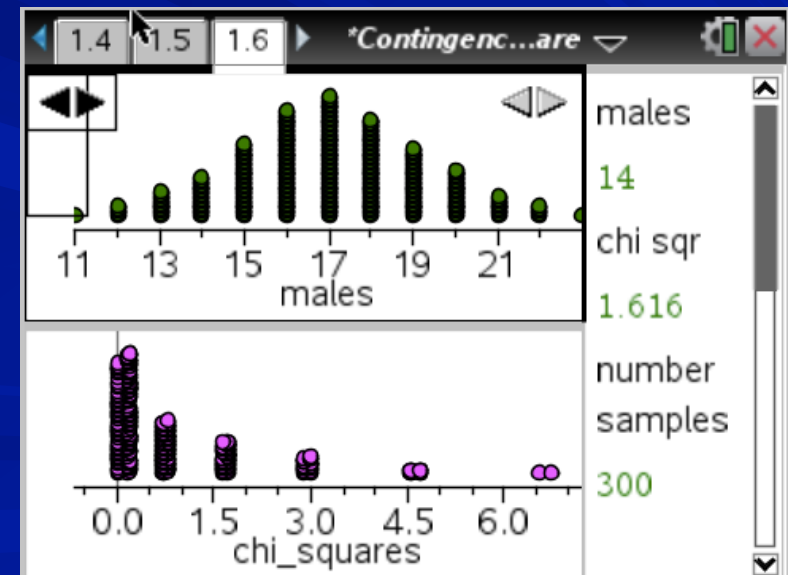
Did the observed outcome of 20 males happen by chance?

Simulation is a tool to develop understanding of fundamental concepts

Percent at or above proficient

District	2006	2007
D.	46	46
E.	38	41
F.	27	37
G.	48	39
H.	53	53
I.	47	40
J.	38	49
K.	47	42
L.	24	29
M.	56	62
N.	61	49
O.	39	40
P.	46	49

Sample size matters
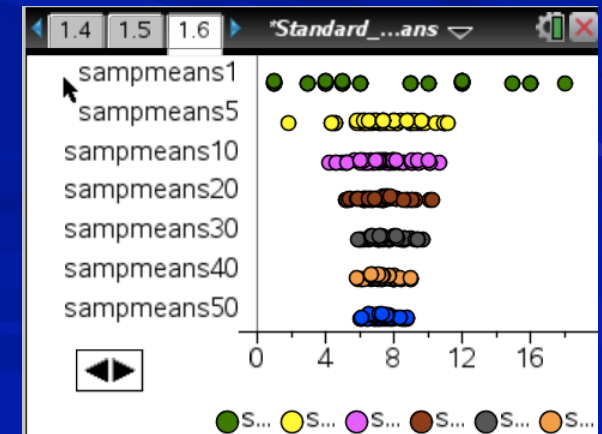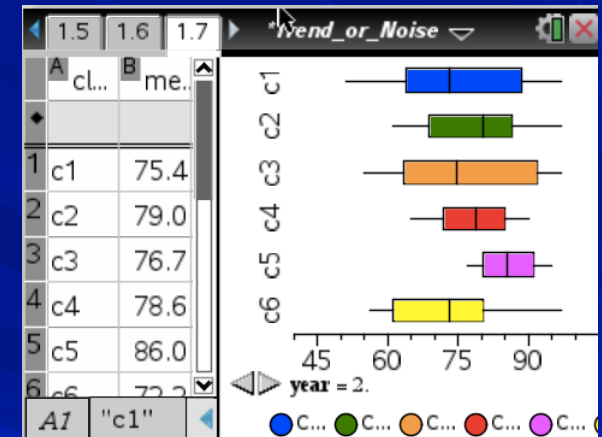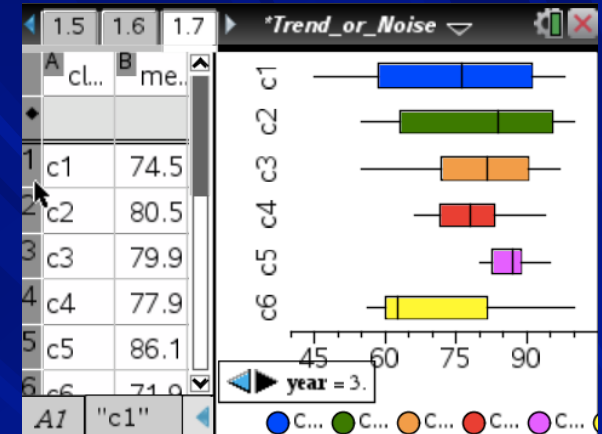
Biting force of crocs

PLoS One Greg Erickson Florida State

Statistics is not mathematics

Statisticians do not do exponential regression
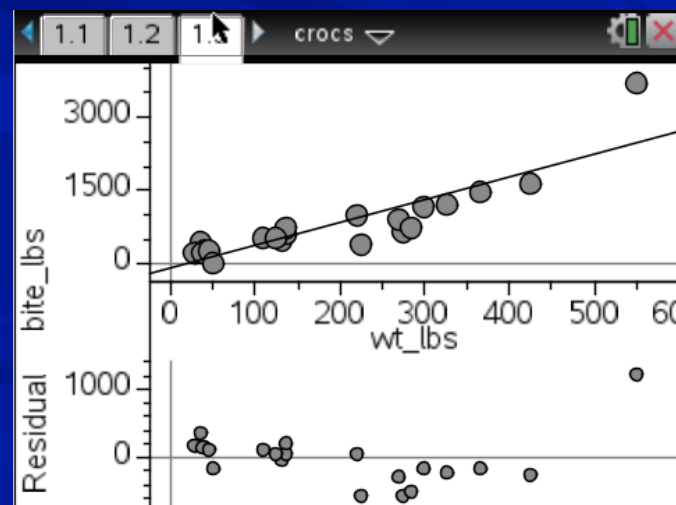
Some principles for teaching statistics

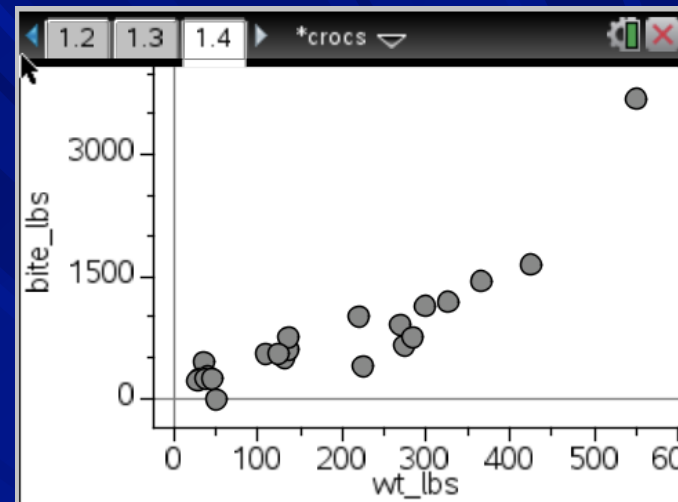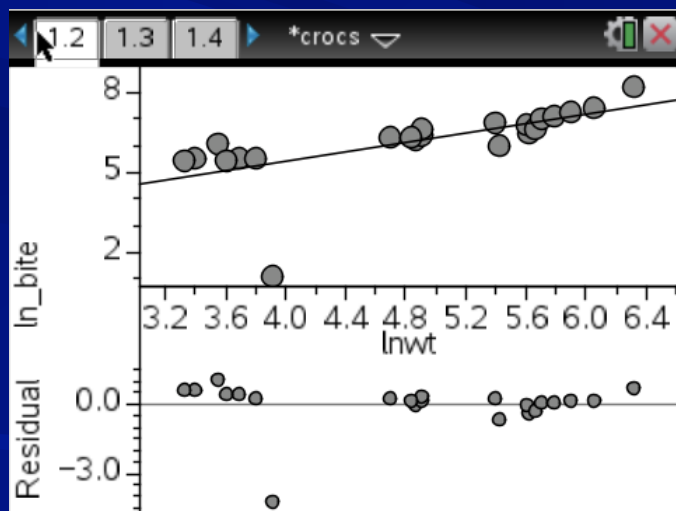- Nothing is certain--but we can make good inferences.
- If you don't know where the data came from and what was asked, you don't know much and you cannot say much.
- Randomness is awesome.
- You have to know what typical behavior is before you can tell when something is not typical.
- Linear regression is all there is.
- Correlation is not very important; r^2 is.
- It is not about making box plots but about the story they tell.

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Recommendations

1. Develop statistical thinking and make the difference between that and mathematical thinking visible
2. Attend to precision
3. Play with real data- including those from educational contexts
4. Stress conceptual understanding, rather than mere knowledge of procedures
5. Foster active learning in the classroom
6. Use technology for developing conceptual understanding and analyzing data

Data Rich, Information Poor

References

- Adelman, C. 2006. *The Tool Box Revisited.* Washington, DC: U.S. Department of Educa- tion, Office of Educational Research and Improvement. Available for download at: www.ed.gov/ rschstat/research/pubs/ toolboxrevisit/index.html

- AIMSweb Charting the path to literacy

- Cut the knot. www.cut-the-knot.org/do_you_know/misuse.shtml

- Common Core State Standards. (2010). Council of Chief State School Officers & National Governors Association Center for Best Practices

- Using Data to Inform Instruction and Personalize Learning: A Continuous Improvement Framework. Advertisement by Editorial Projects in Education, Inc., 6935 Arlington Road, Suite 100, Bethesda, MD 20814. EPE is the publisher of *Education Week*, *Digital Directions*, *Teacher Professional Development Sourcebook*, edweek.org, teachermagazine.org, DigitalDirections.org, and TopSchoolJobs.org. Copyright © 2013 Editorial Projects in Education.

- Wilson, D. M. (Ed.). Statistical Significance. The magazine of the Harvard Graduate School of Education, Winter 2012 www.gse.harvard.edu/news-impact/2012/01/statistical-significance/ #ixzz2RwrcGCn9