What is the status of Statistics in the K-12 curriculum the USA?

What is the current use of technology in classrooms in developing understanding of statistical concepts and procedures in the USA?

What potential future roles do you see for technology in developing understanding of statistical concepts and procedures in the USA?

Patrick Scott (pscott@nmsu.edu)
Inter-American Math Education Committee (IACME)
US National Commission on Math Instruction (USNC/MI)
María Hernández (hernandez@ncssm.edu)
North Carolina School of Science and Math (NCSSM)

GAISE Report (2005)

Guidelines for Assessment and Instruction in Statistics Education

Statistical problem solving is an investigative process that involves four components:

I. Formulate Questions

→ clarify the problem at hand
→ formulate one (or more) questions that can be answered with data

II. Collect Data

→ design a plan to collect appropriate data
→ employ the plan to collect the data

III. Analyze Data

→ select appropriate graphical and numerical methods
→ use these methods to analyze the data

IV. Interpret Results

→ interpret the analysis
→ relate the interpretation to the original question

GAISE was a strong influence on the following efforts:

Common Core (2010)

Common Core State Standards for Math (CCSS-M)

K-5: No specifics, but opportunities are present in Measurement and Data

6: Explore univariate data

7: Produce data through randomization; informal inference (simulation); single event probability

8: Explore bivariate data

9-12: summarize and interpret data (normal model; simple linear regression); design randomized studies; informal inference (margin of error, statistical significance)

NextGen (2013)

Next Generation Science Standards (NGSS)

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

MET II (2012)

Mathematical Education of Teachers

Elementary Grades (K-5): Data exploration at least at the level of the grade 6 recommendation in the CCSS-M

Middle Grades (6-8): A modern introductory statistics course plus a course emphasizing the teaching of statistics

High School Grades: Two courses in statistical content; additional material in professional development or graduate school contexts, especially for those planning to teach AP Statistics

Led to the Statistical Education of Teachers (*SET*) by the American Statistical Association (ASA)

The Reality

“Changing the culture of statistics programs in order to adapt to the needs of teachers will be a major challenge for both the statistics and mathematics education communities, but it is an essential cultural shift that can be achieved by these two communities working together.”

Scheaffer, R.L. & Jacobbe, T. (2014). Statistics education in the K-12 schools of the United States: a brief history. *Journal of Statistics Education*, 22(2).

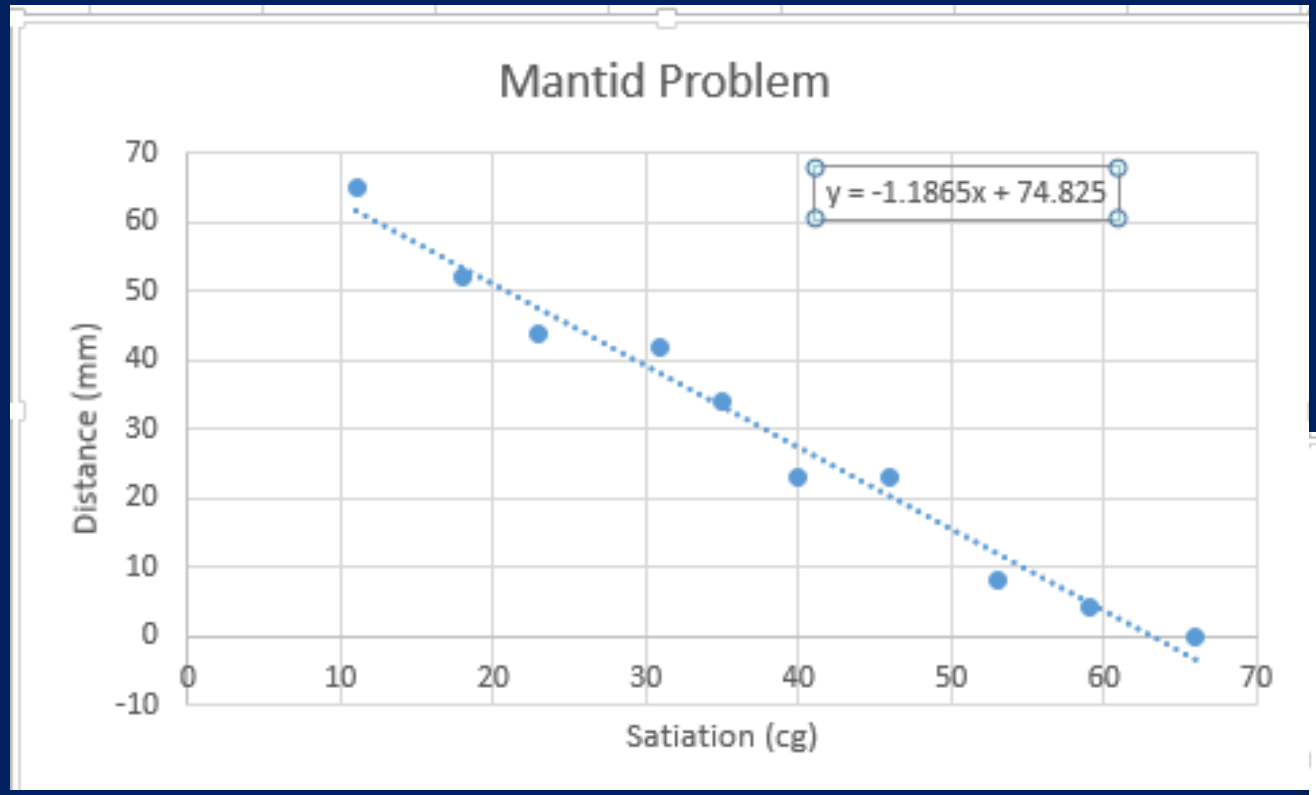
Statistical Software in Education

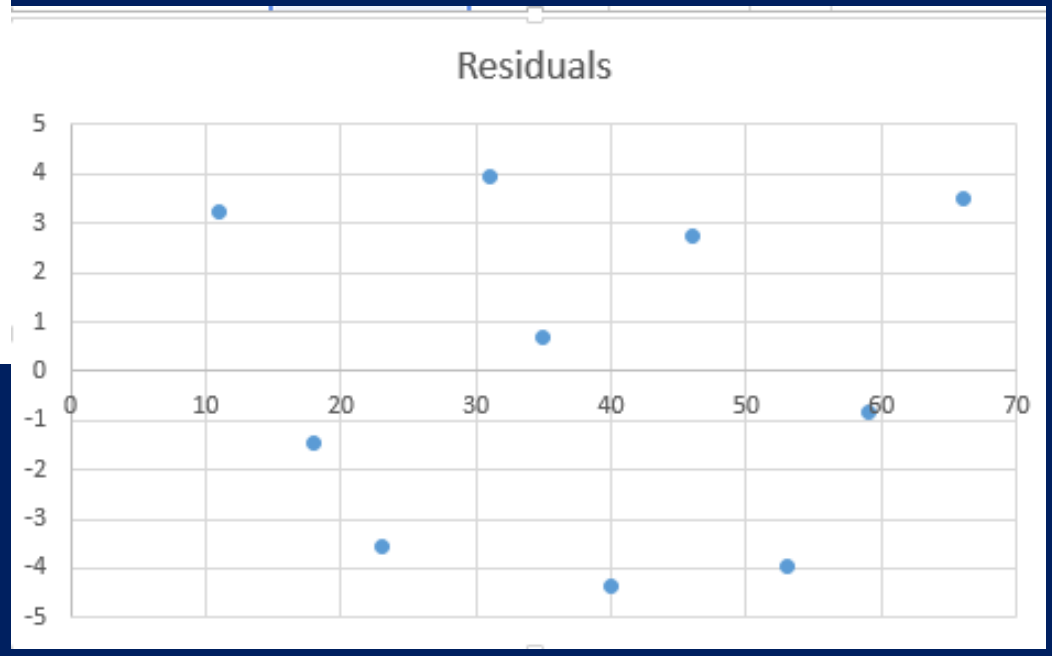
- Bivariate Data:

  Excel, Geogebra, TI Nspire, TI Graphing Calculator, LoggerPro

- NCTM Core MathTools
- Fathom
- JMP
- Website - GapMinder

Excel for Linear Regression and Residuals





Rossman/Chance Applet Collection

Random Babies

Number of trials: 6

```
*** Cumulative Results ***
Matches Count   Prop
0       2       0.333
1       3       0.500
2       1       0.167
3       0       0
4       0       0
average:  0.833
```

Number of Matches: 1

Animate

Show Theoretical

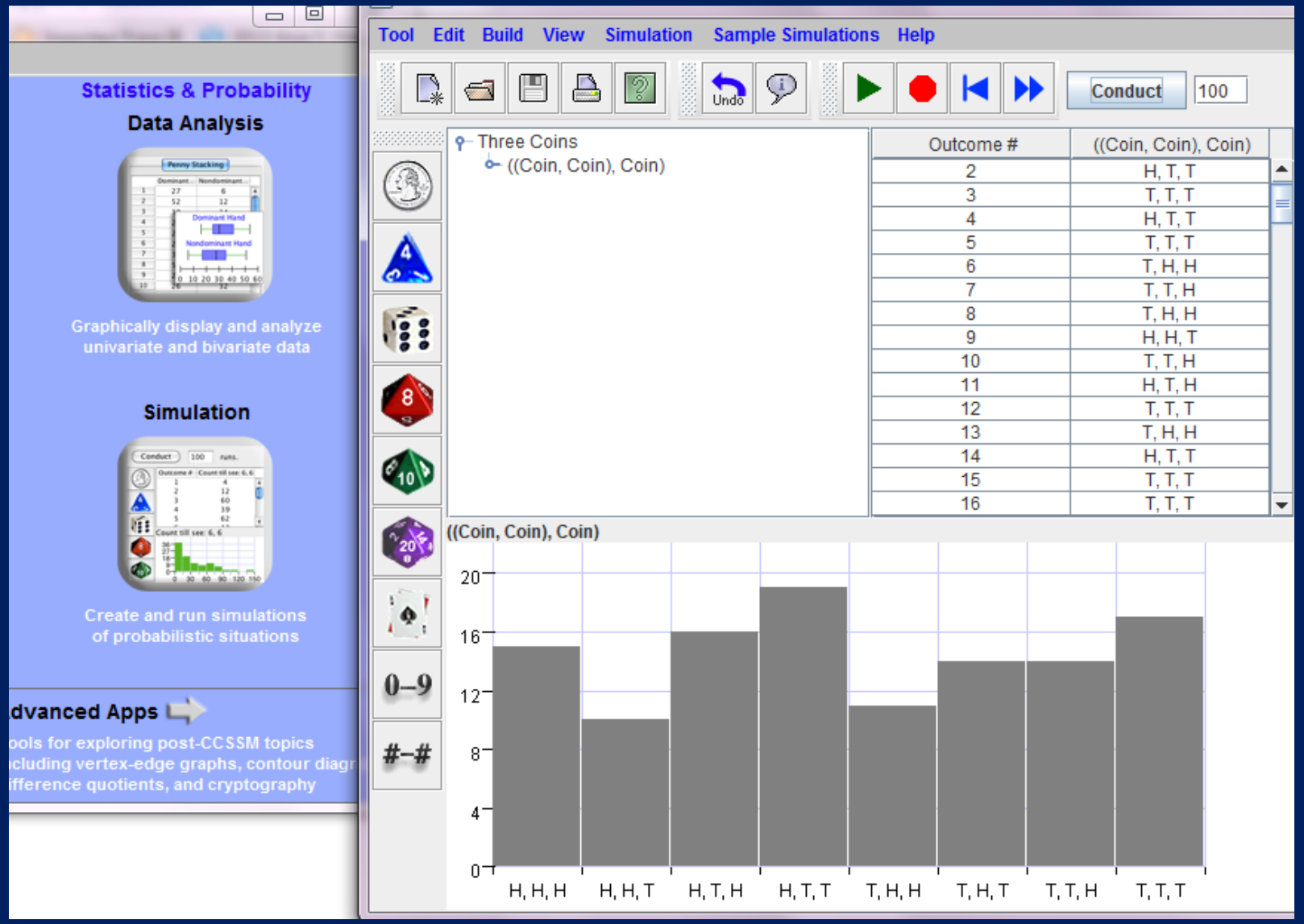
Number of babies 4

Number of trials 1

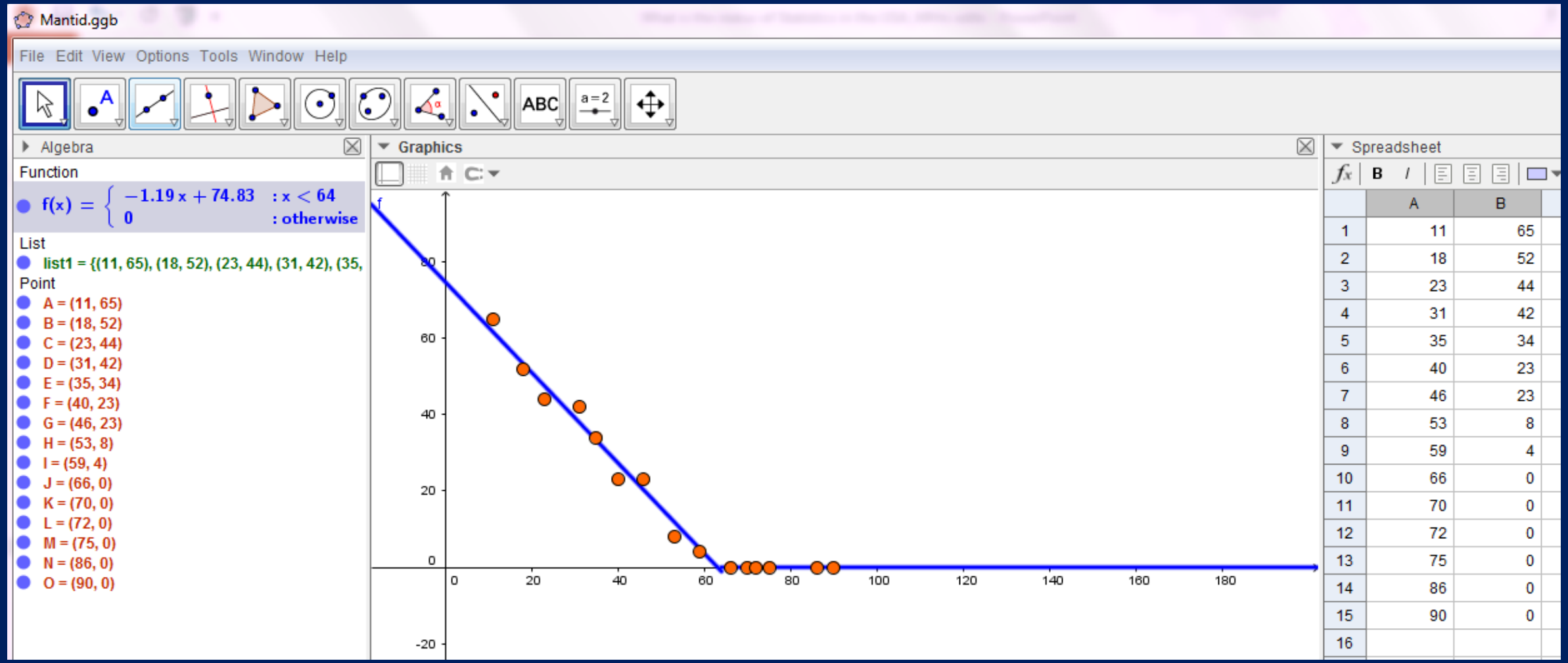
Randomize Reset

Average Relative Frequency

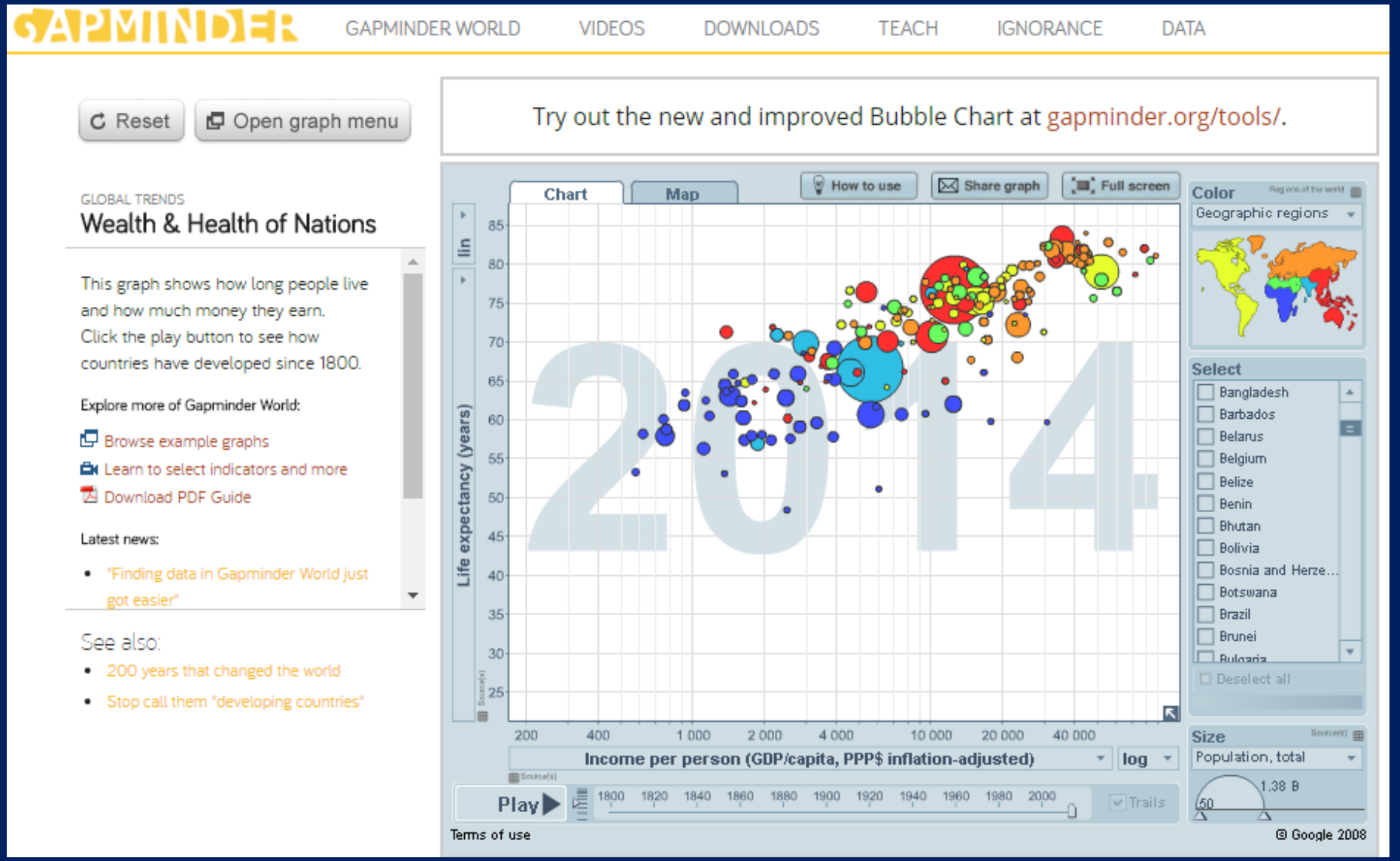
NCTM Core Math Tools



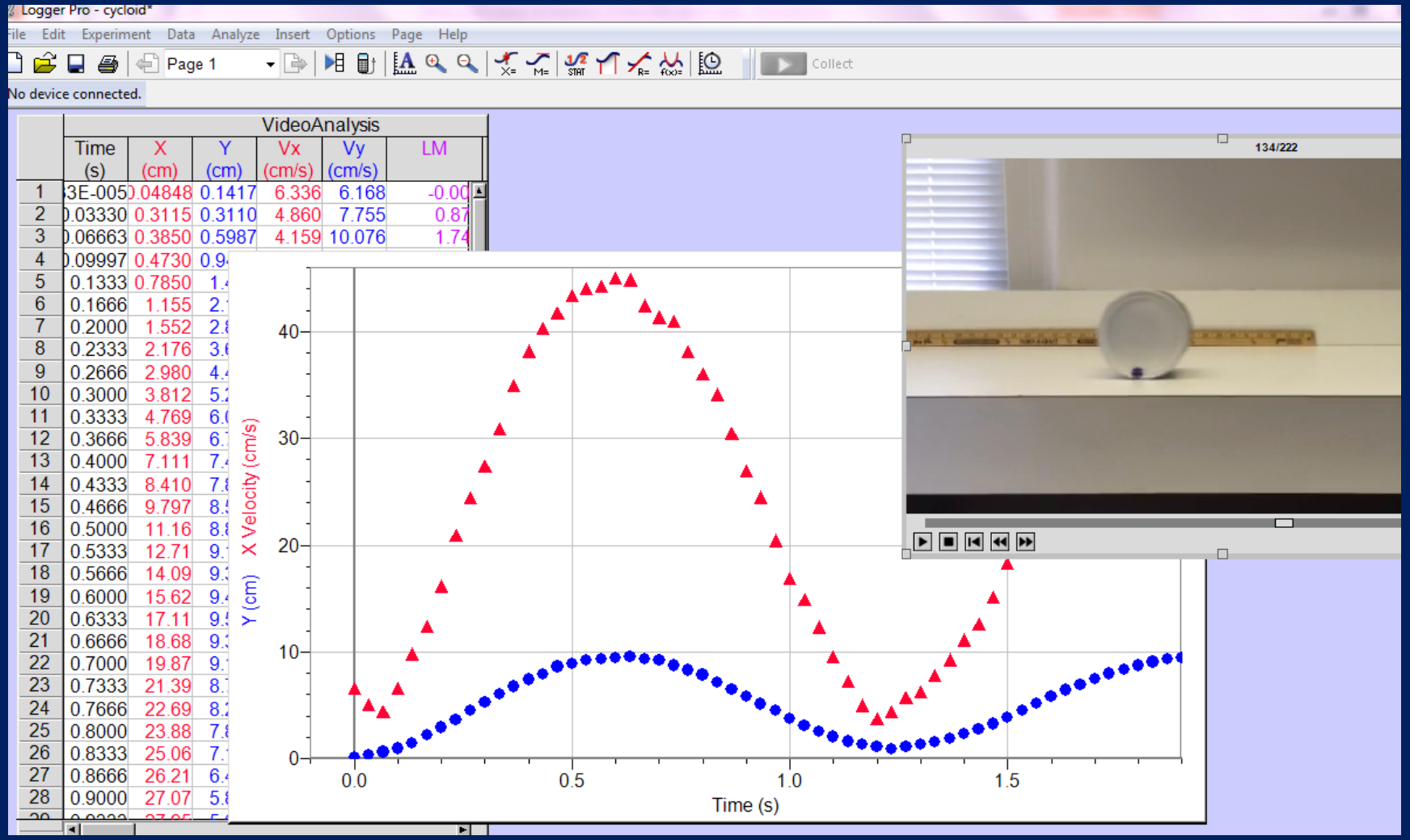
Geogebra


Mantid.ggb
File Edit View Options Tools Window Help
Algebra
Function
f(x) = −1.19 x + 74.83 : x < 64
0 : otherwise
List
list1 = {(11, 65), (18, 52), (23, 44), (31, 42), (35,
Point
A = (11, 65)
B = (18, 52)
C = (23, 44)
D = (31, 42)
E = (35, 34)
F = (40, 23)
G = (46, 23)
H = (53, 8)
I = (59, 4)
J = (66, 0)
K = (70, 0)
L = (72, 0)
M = (75, 0)
N = (86, 0)
O = (90, 0)
Graphics
Spreadsheet
A B
1 11 65
2 18 52
3 23 44
4 31 42
5 35 34
6 40 23
7 46 23
8 53 8
9 59 4
10 66 0
11 70 0
12 72 0
13 75 0
14 86 0
15 90 0
16

Gapminder World



LoggerPro –
Collecting data from probes and videos



Using and Helping to Generate “Big Data”

The Global Learning and Observations to Benefit the Environment (GLOBE) Program

- International science and education program
- provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and
- contribute meaningfully to our understanding of the Earth system and global environment.
- Sponsored by NASA, NSF, NOAA and US Dept of State

The Reality

- High schools students have access to TI-84 graphing calculators in the classroom – can use simulation tools and Stats Editor. Some middle school students have access to a graphing calculator.
- Bring your own devices (BYOD) policies are becoming somewhat more prevalent.
- Most teachers have access to a computer in their classes and a projector for demonstrations.
- Some students have access to computers or tablets.

Question for the future…

How can we leverage technology to help students build conceptual knowledge of statistical topics in this changing world?