Data Science in K12

RADICAL INNOVATION FOR SOCIAL CHANGE

Summary

1. The world is newly awash in data
2. Everyone needs data-related skills to navigate this new world
   - Decisions that used to be simple are now complex
   - Most jobs, and nearly all the good jobs, require these skills
3. We are not preparing our kids well for this change
4. Reshaping what we emphasize in math is critical
5. We want to work with you to make this change possible

Every Second of Every Day the World Creates Enough Data to Fill Fifty New Libraries of Congress

Source: Center of RISC Analysis; Domo https://www.domo.com/learn/data-never-sleeps-6

The Internet is Feeding This Phenomenon

More than 4 billion people are now on the Internet

Source: Internet Live Stats: http://www.internetlivestats.com/

So is the Proliferation of Smartphones

5 billion smartphones in the world in 2017

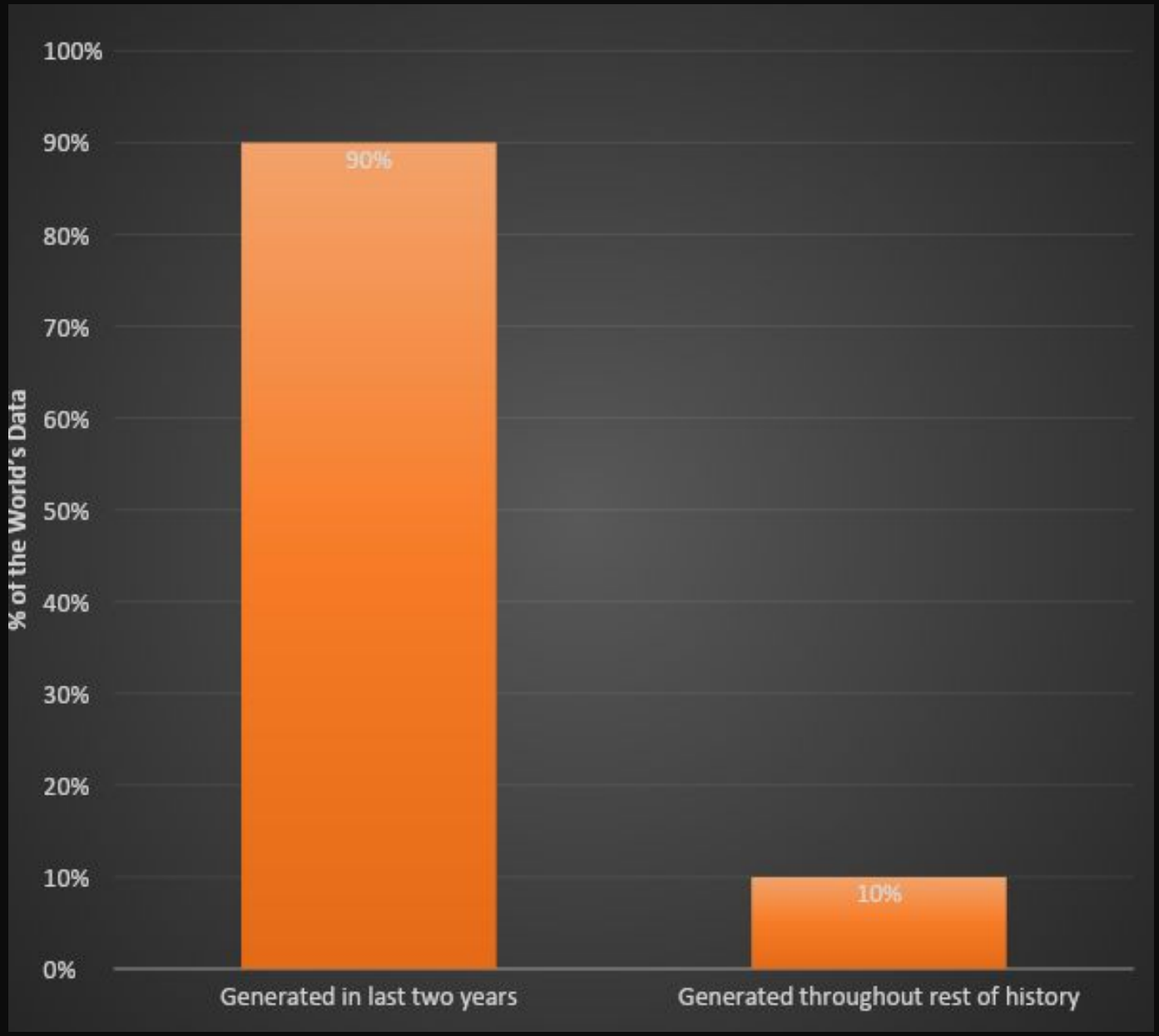
Source: GSMA Intelligence. https://www.gsma.com/newsroom/press-release/number-mobile-subscribers-worldwide-hits-5-billion/ ; Internet Live Stats: http://www.internetlivestats.com/

Immensely Powerful Computers in Our Pockets

Today's iPhone 8 has a thousand times more storage capacity than a multi-million dollar mainframe computer in the 1970s.

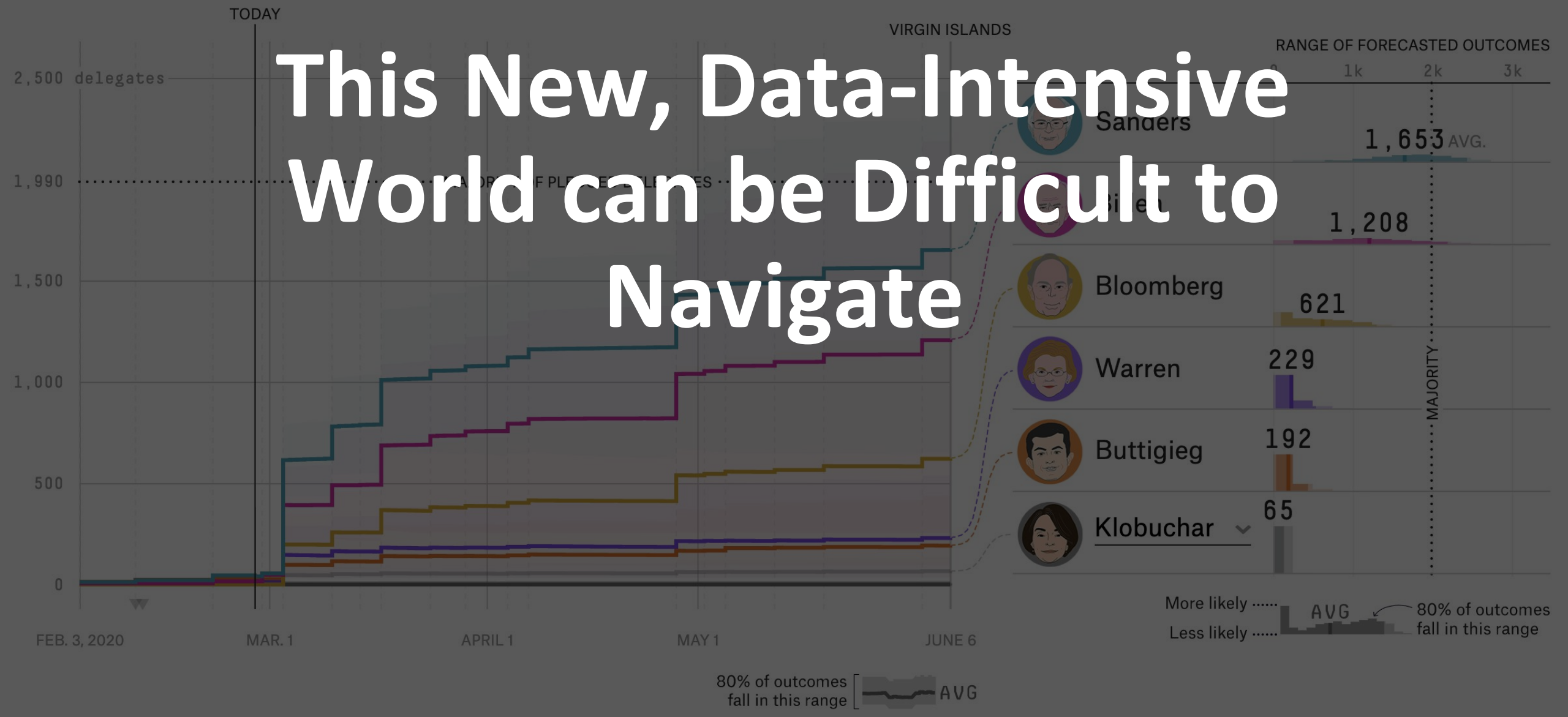
Source: RISC analysis of current Apple product specifications and historical IBM 370/model 145 specifications: (https://www.businessinsider.com/ibm-1970-mainframe-specs-are-ridiculous-today-2014-5)

Feeding a Data Explosion – 90% of the World's Data Have Been Created in the Last Two Years



Source: Domo https://www.domo.com/learn/data-never-sleeps-6

delegates, on average, each candidate is projected to have pledged to them at each point in the primary season, along with a range of possible delegate counts. We're also showing the distribution of simulated final pledged delegate counts in the table, where taller bars mean a more likely outcome. Right now, many candidates, even the front-runners, wind up with tall bars close to zero — generally, those are simulations where the candidate dropped out before having a chance to accumulate many delegates.



This New, Data-Intensive World can be Difficult to Navigate

Decisions That Used to be Straightforward are Now More Complex

Your Balance History

1-Month | 1-Year | 2-Year | Year-to-Date

See how recent account activity may have affected your balance.

Showing 01/30/2018 - 01/30/2019. Excludes Institutional Wealth Services, life insurance accounts, and stock plan accounts.

News About Your Investments

Mid-Day ETF Update: ETFs, Stocks Mixed as Street Digests Earnings, Economic Data
MT NEWSWIRES 1:25 PM

ETF Preview: ETFs, Futures Mostly Higher on Fed's Policy Shift; Facebook Leads Gainers on Record Q4 Profit
MT NEWSWIRES 9:17 AM

SPDR S&P 500 ETF Trust: Pivot points (TheFlyOnTheWall)
THE FLY 8:17 AM

Mid-Day ETF Update: ETFs, Stocks Higher Ahead of FOMC Policy, Powell Statement
MT NEWSWIRES 01/30/2019 1:36 PM

Show more news.

Your 2018 Tax Information

Get up-to-date information on the status of your tax forms

View your tax forms

Visit Tax Information for all of your tax needs including special discounts with tax providers.

Your Asset Allocation[1]

The current asset allocation of your selected accounts most closely resembles **Most Aggressive**.

Learn more about your asset allocation

Unsettled trades may materially impact information displayed and render this information unreliable.

Today's Markets

U.S. Markets Closed.

Crude Oil 54.02 -0.39% Gold 1,319.70 +0.75% US 10 Year 26.35 -2.23%

View more market & sector performance

AS OF 01/31/2019 04:27 PM ET ##

Top News

Amazon first-quarter sales forecast misses estimates, shares down
REUTERS - 4:16 PM ET 1/31/2019

Musk not worried about Tesla Model 3 demand, Wall Street thinks otherwise
REUTERS - 3:03 PM ET 1/31/2019

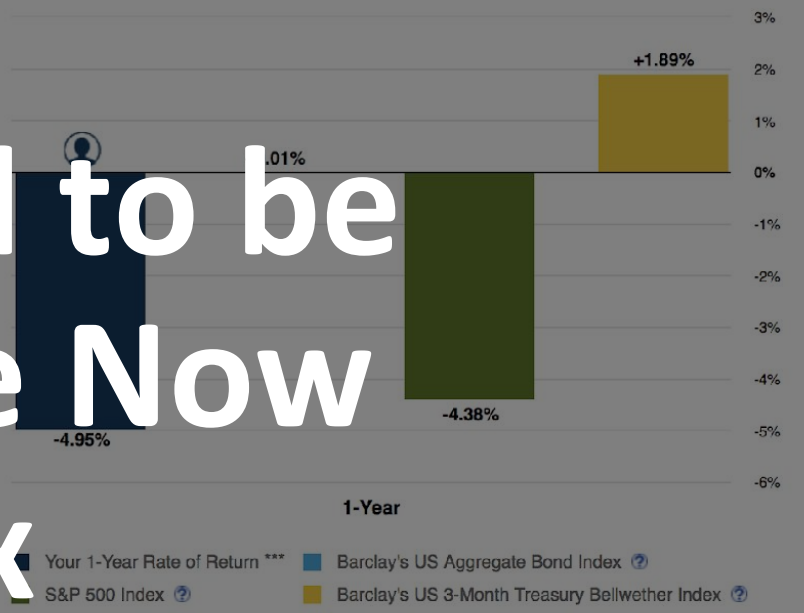
Jeff Bezos' Blue Origin signs launch deal with Canada's Telesat
REUTERS - 1:26 PM ET 1/31/2019

View more news

See how your returns compare to the market

Review how the 1-year investment return of your selected account(s) stacks up against broader market performance.

Tell us what you think



Get additional performance details

Your Top & Bottom Movers

Symbol	Today's Gain/Loss	Last Price
SPY SPDR S&P500 ETF TRUST S&P 500 ETF USD DIS	$1,447.60 (0.88%)	$269.930

AS OF 01/31/2019 4:28 PM ET

Take a closer look at your positions.

Is Drinking Wine Better Than Going To The Gym? According To Scientists, Yes!

By *Natalie Roterman* | *Sep 15 2014, 04:51PM EDT*

Source: https://www.buzzfeed.com/carolynkylstra/hype-in-health-journalism

Extra glass of wine a day 'will shorten your life by 30 minutes'

Drinking is as harmful as smoking, and more than five drinks a week lowers life expectancy, say researchers

▲ Health benefits from drinking alcohol? Sorry, but it's just another case of something that is too good to be true, say experts. Photograph: Inti St Clair/Getty Images/Blend Images

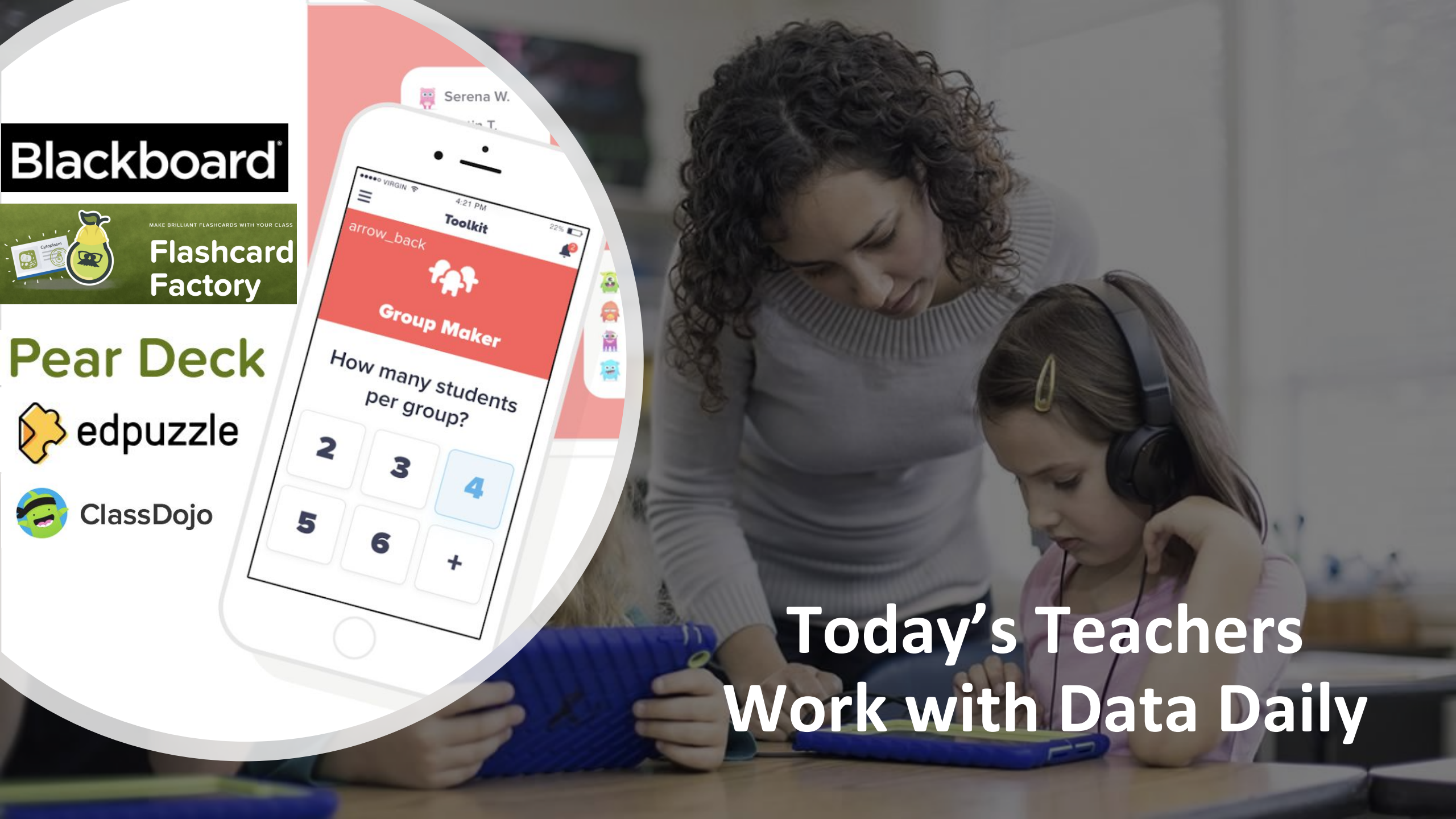
Source: https://www.theguardian.com/science/2018/apr/12/one-extra-glass-of-wine-will-shorten-your-life-by-30-minutes

Separating Fact from Fiction is Getting Harder

Data are Changing the Nature of Our Work. Fixing a Car Used to be Simpler

Today’s Mechanics
are Immersed in Data

Teachers Have Had to Adapt Too


Blackboard
MAKE BRILLIANT FLASHCARDS WITH YOUR CLASS
Flashcard Factory
Pear Deck
edpuzzle
ClassDojo
Serena W.
VIRGIN
4:21 PM
Toolkit
22%
arrow_back
Group Maker
How many students per group?
2
3
4
5
6
+
Today's Teachers Work with Data Daily

Employers are Desperate to Find People with Data-Related Skills

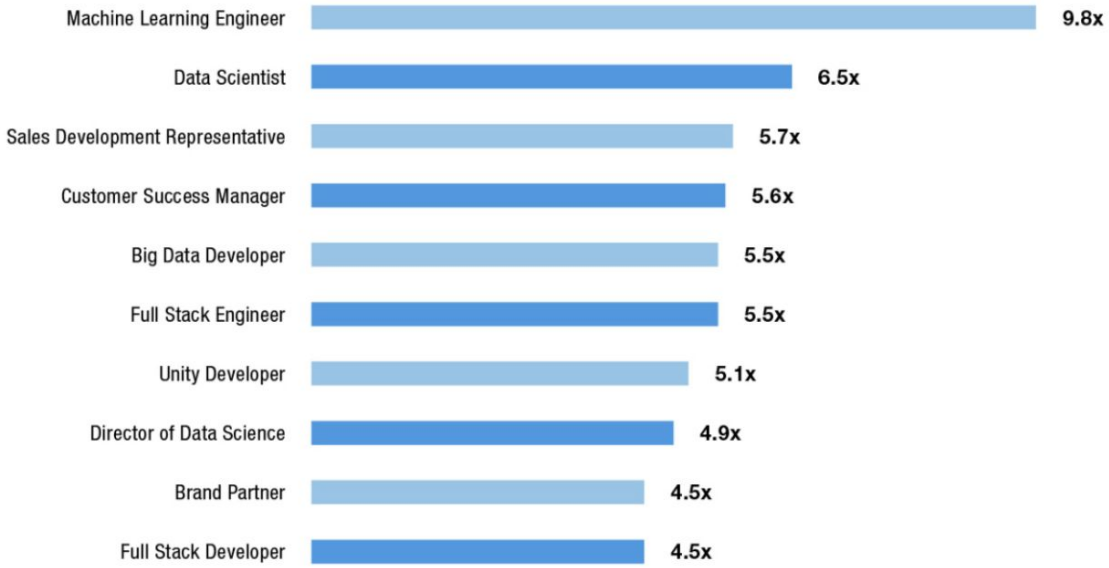
UNITED STATES

40%

of U.S. companies report difficulty in filling positions because of a lack of STEM skills.[1]

Source: https://www.brookings.edu/interactives/still-searching-job-vacancies-and-stem-skills/

Top 10 Emerging Jobs



Source: https://business.linkedin.com/talent-solutions/blog/trends-and-research/2017/here-are-the-20-fastest-growing-jobs-in-the-us

College Students are Responding by Changing Their Majors

Top Majors at Stanford in 2015

1. Computer Science
2. Human Biology
3. Engineering
4. Mechanical Engineering
5. Science, Technology & Society

Source: https://stanfordmag.org/contents/the-five-most-popular-majors-at-stanford

Student Majors at Harvard

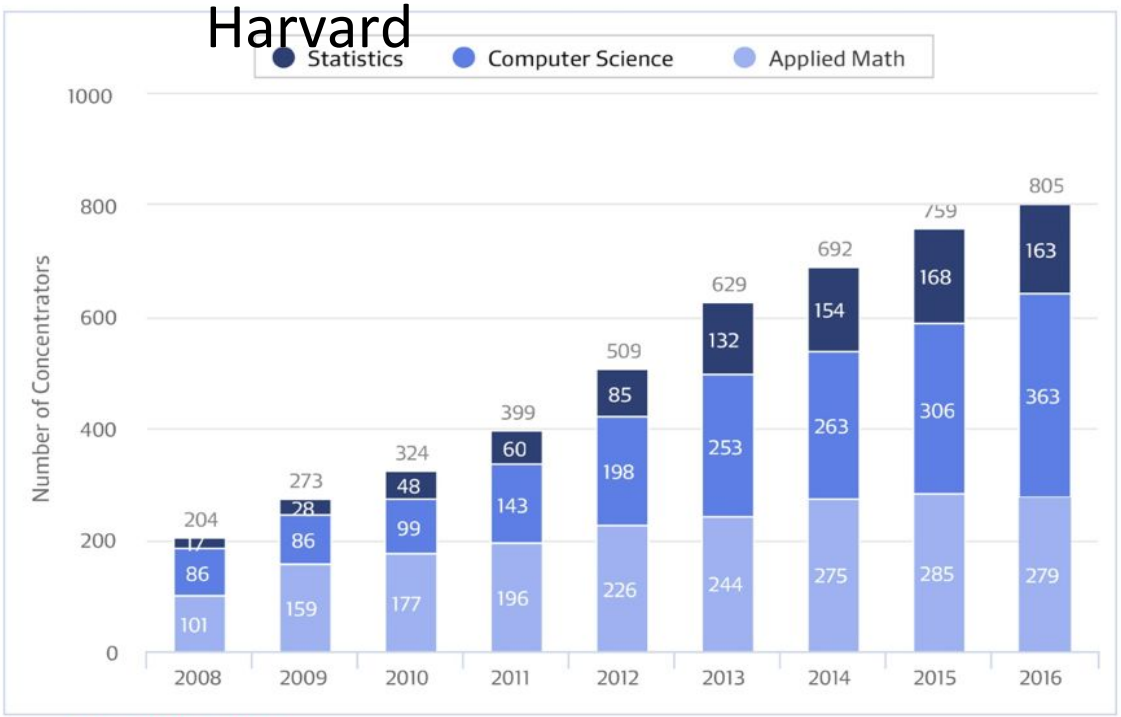
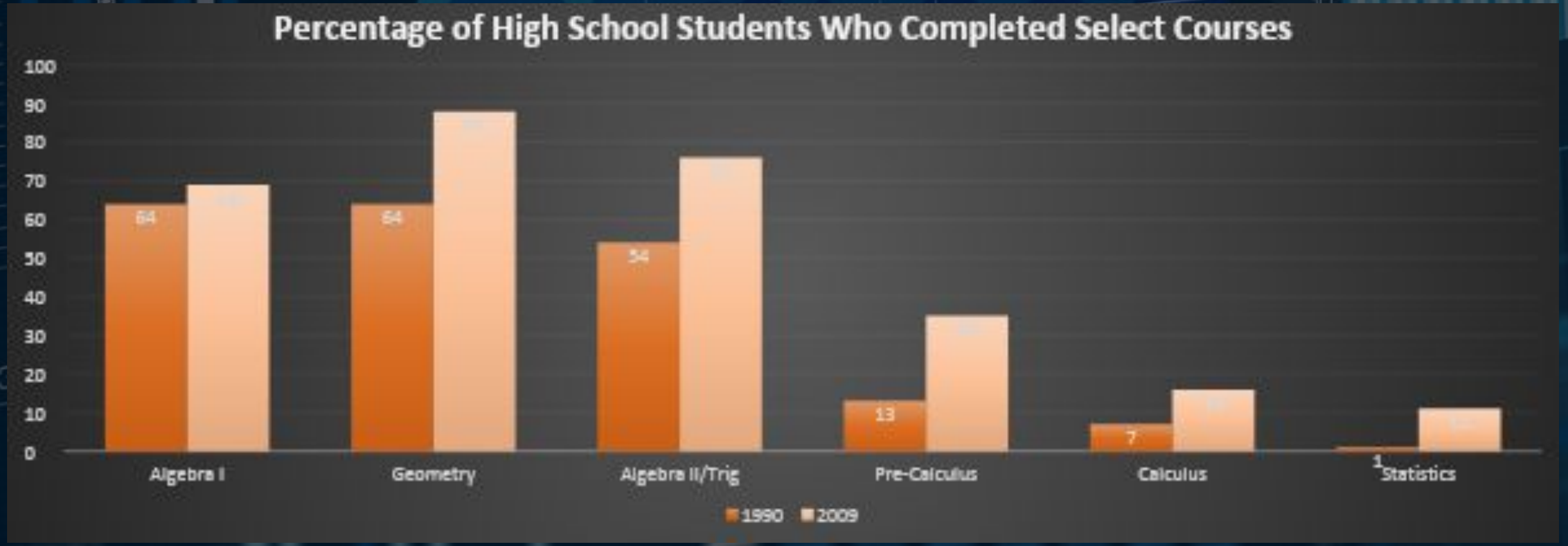


Photo: Morgan J. Spaulding

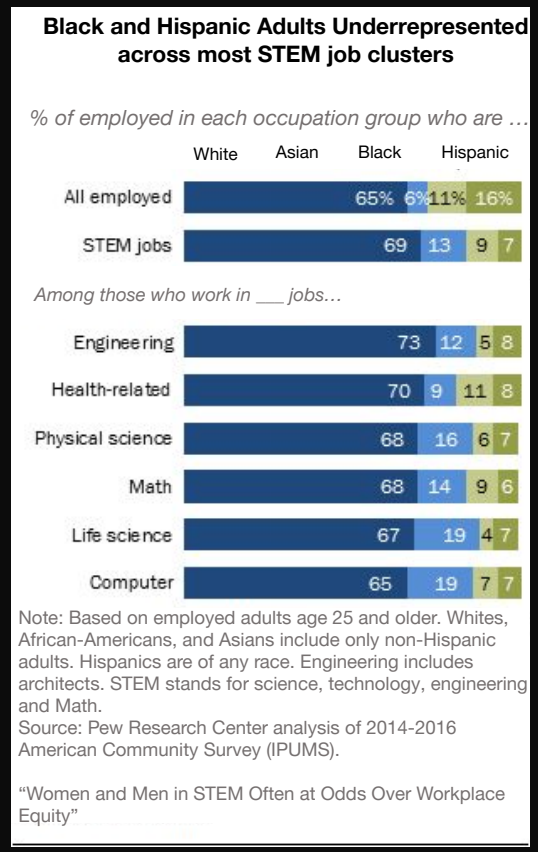
Source: http://www.exploringcs.org/archives/resources/cs-statistics

But What About Our High School Students? Data Science is Absent from the Curriculum.



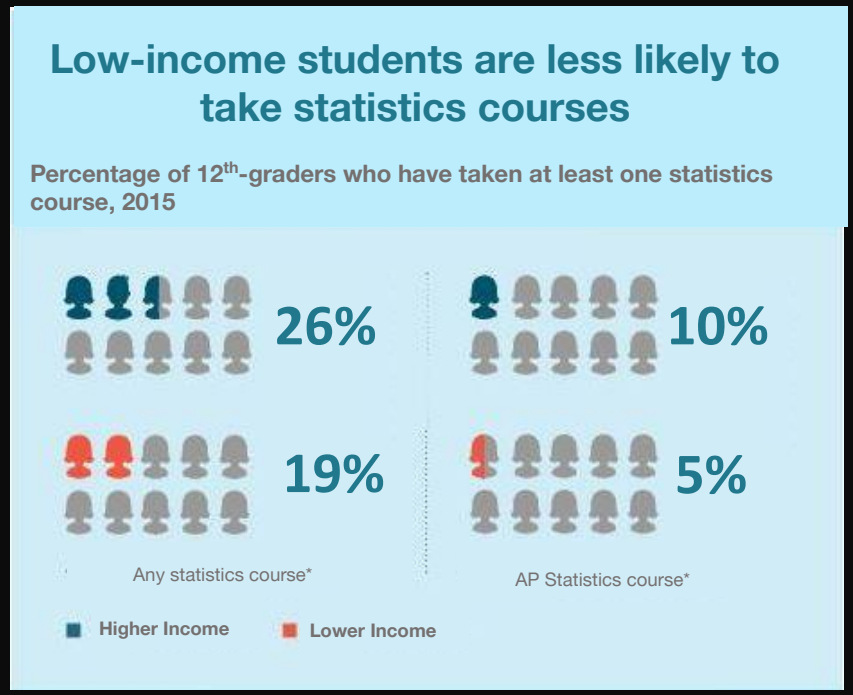
Underserved Students Pay the Highest Price

Racial disparities



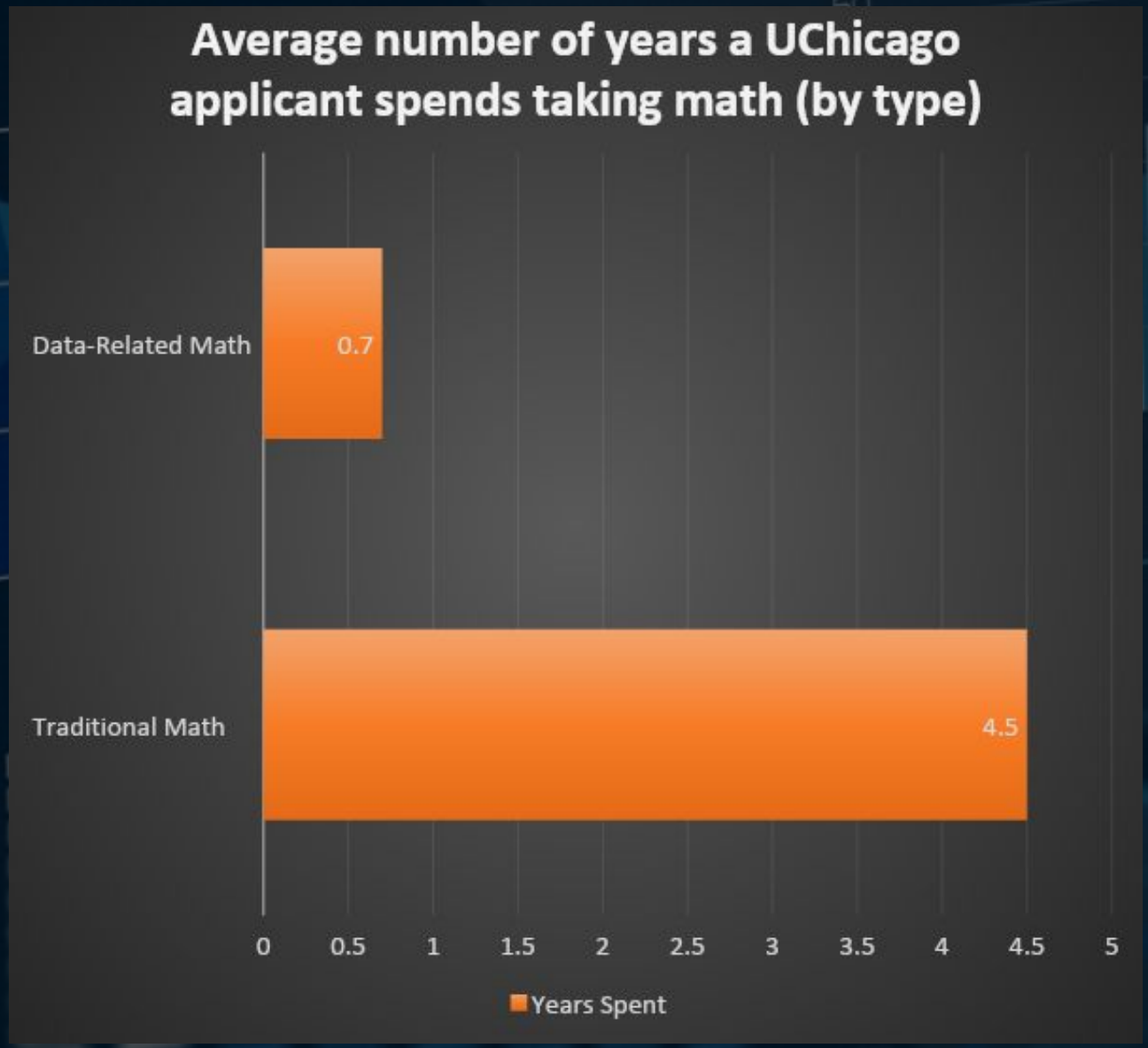
Source: http://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stem-workforce-varies-widely-across-jobs/

Socioeconomic disparities



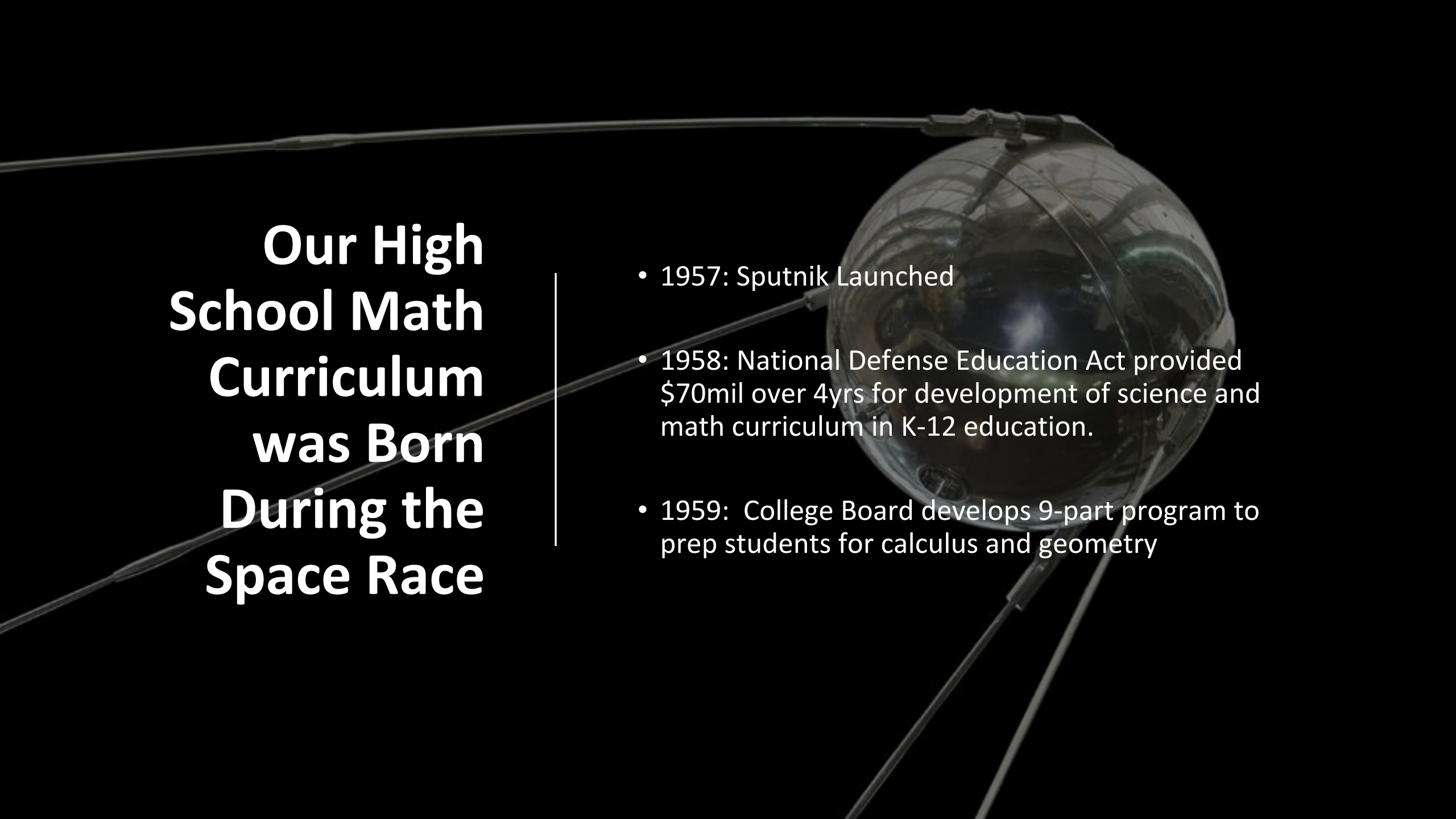
Source: http://blogs.edweek.org/edweek/curriculum/2016/09/1_in_4_high_school_seniors_take_statistics.html

Even the Most Privileged Students with the Most Opportunities, Learn Little About Data



* Includes statistics, computer science, research-focused courses
** includes algebra, geometry, algebra II, and calculus

Source: Representative sample of transcript data from 250 applicants to the University of Chicago



Our High School Math Curriculum was Born During the Space Race

- 1957: Sputnik Launched
- 1958: National Defense Education Act provided $70mil over 4yrs for development of science and math curriculum in K-12 education.
- 1959: College Board develops 9-part program to prep students for calculus and geometry

When Calculus was King and Engineers were Needed to Build Our Rockets

When Computers and Data were Far Less Important to Our Success

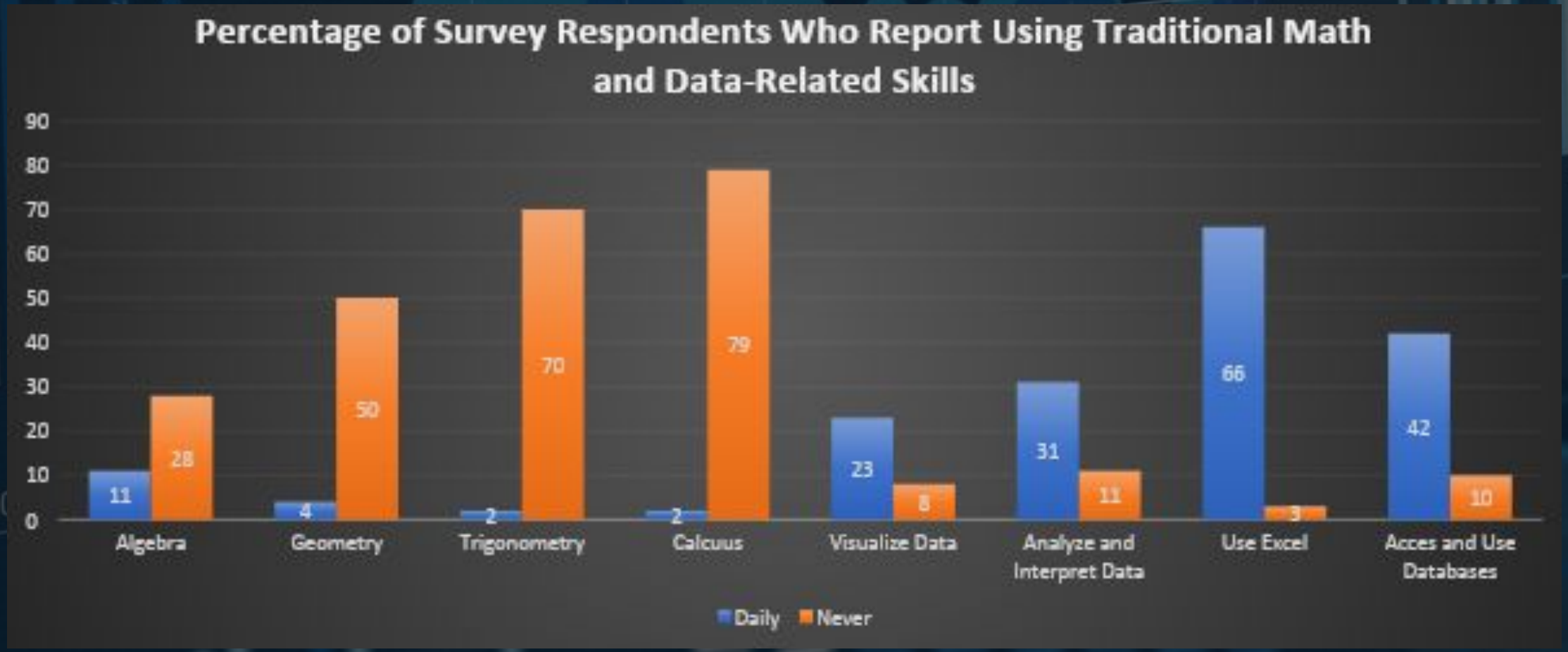
- The Apollo Guidance Control computer had less computing power than a classic Nintendo GAME BOY (first introduced in 1989)

Source: https://en.wikipedia.org/wiki/Apollo_Guidance_Computer ; https://www.nintendo.co.uk/Support/Game-Boy-Pocket-Color/Product-information/Technical-data/Technical-data-619585.html

“Very Few People Actually Use Calculus in a Conscious, Meaningful Way in Their Day-to-Day Lives”

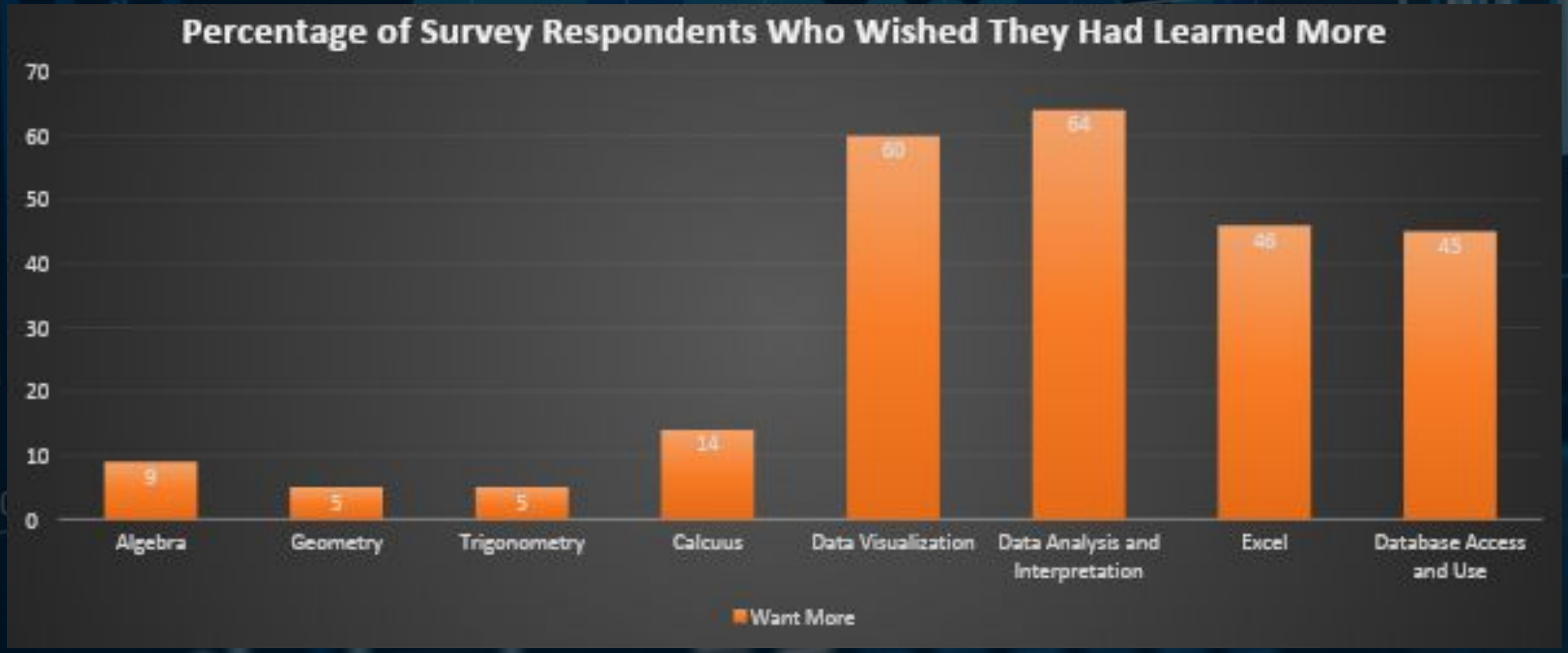
Arthur T. Benjamin
Professor of Mathematics
Harvey Mudd College

A Tiny Fraction of Today's Workers Use Traditional High School Math, But They Do Use Data Frequently



Source: Survey distributed via Freakonomics tweets and web site; respondents not representative—skewed male, higher income, higher education

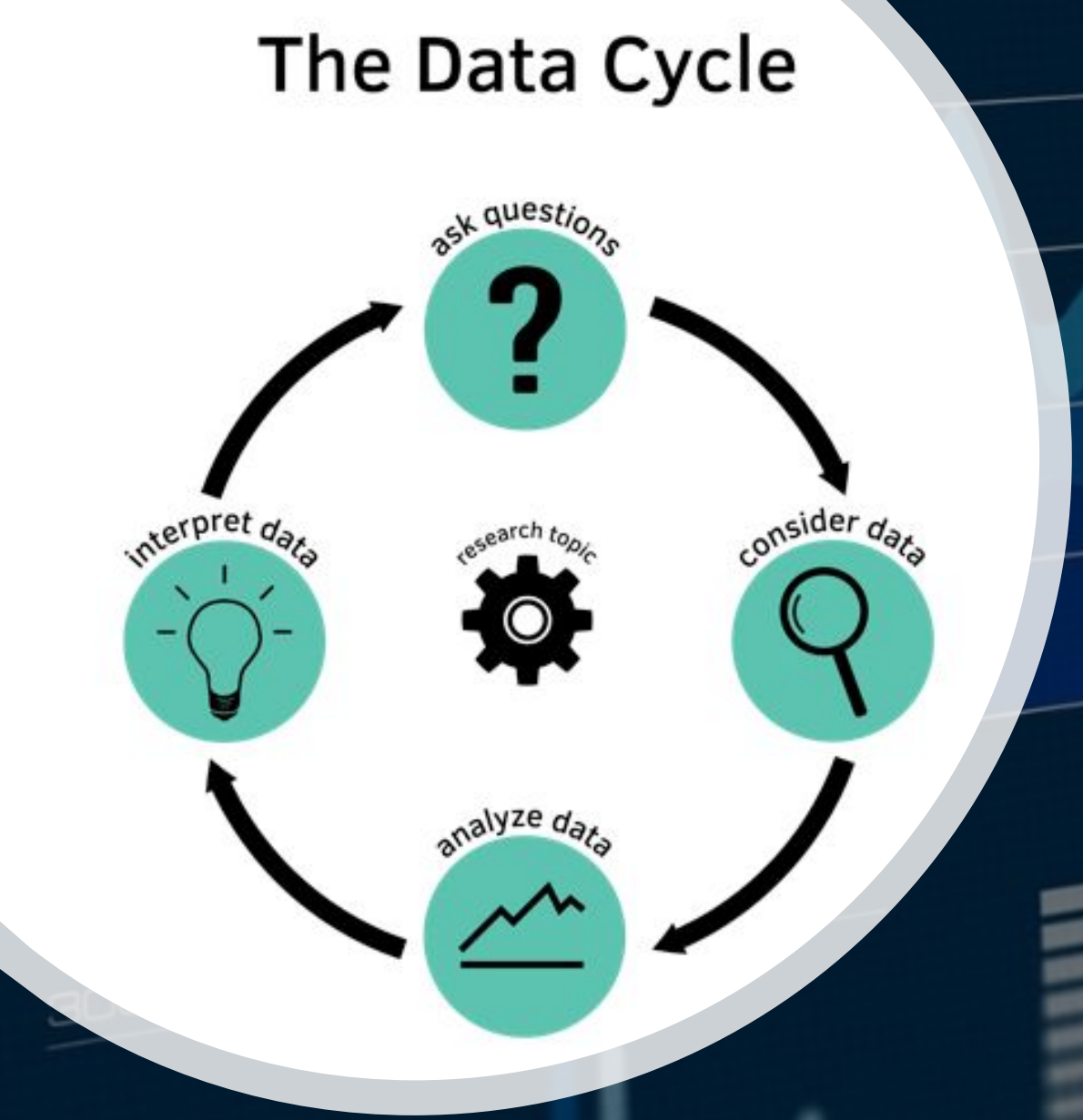
Many of Today's Workers Wish They Had Learned Different Math



Source: Survey distributed via Freakonomics tweets and web site; respondents not representative—skewed male, higher income, higher education

Today's World Requires We Know How to:

- Find information and sort the good from the bad
- Interpret data from tables and charts
- Analyze data to discover hidden insights
- Visualize and present data to make an argument
- Use common analytical software (e.g. Excel, Google Spreadsheets)



So We Need to Teach Our High School Children How to . . .

Ask Questions

- Generate hypotheses

Consider Data

- Understand how data are used to address real-world problems and are used in all facets of modern life

Analyze Data

- Analyze statistical graphics to identify patterns in data and to connect these patterns back to the real world

Interpret Data

- Critically evaluate shortcomings and strengths in the data and the data collection process

And Help Students…

- Develop computational and statistical thinking skills
- Interpret categorical and quantitative data
- Make inferences and justify conclusions
- Seek data to answer questions or support/undermine claims
- Understand conditional probability and the rules of probability
- Evaluate and fit models to data
- Interpret analyses of data and communicate findings

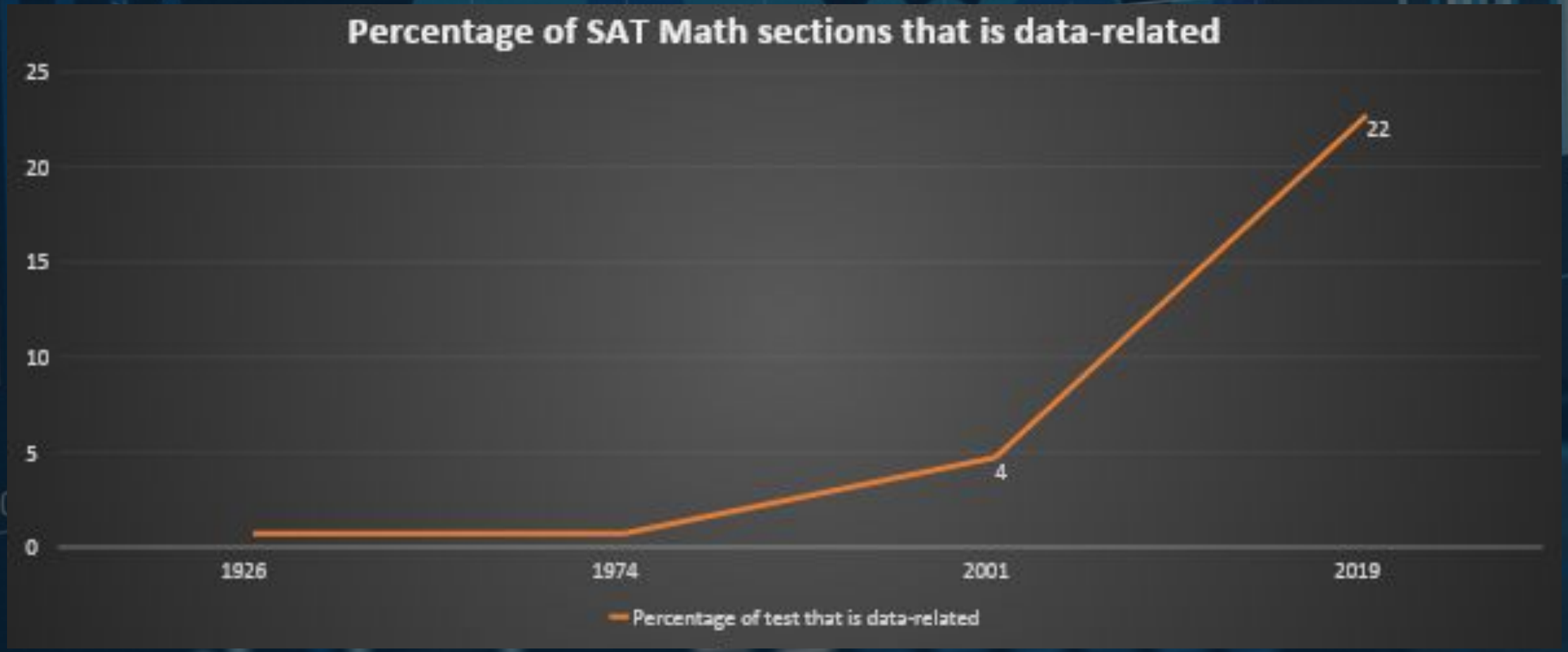
ACT®

achieve more®

SAT®

Helping Students Become Data Fluent Will Better **Prepare Them for College and the Workforce** and Also **Boost High-stakes Test Scores**

Over Time, the SAT Has Changed to Reflect a Data-driven World



And Not Just in Math! Data Fluency is Throughout the SAT

Questions 12-22 are based on the following passage and supplementary material.

Dark Snow

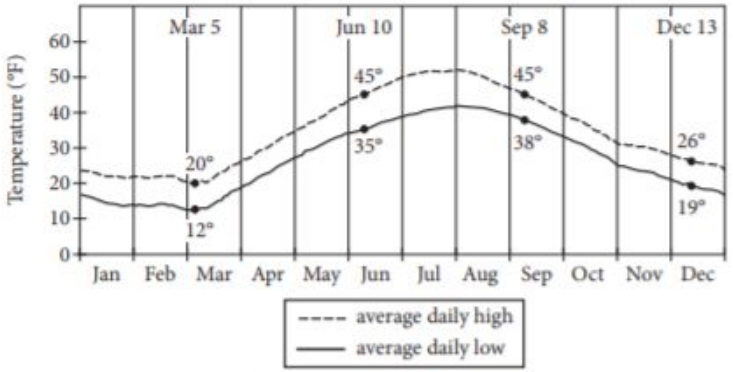
Most of Greenland's interior is covered by a thick layer of ice and compressed snow known as the Greenland Ice Sheet. The size of the ice sheet fluctuates seasonally: in summer, average daily high temperatures in Greenland can rise to slightly above 50 degrees Fahrenheit, partially melting the ice; in the winter, the sheet thickens as additional snow falls, and average daily low temperatures can drop 12 to as low as 20 degrees.

12

Which choice most accurately and effectively represents the information in the graph?

A) NO CHANGE
B) to 12 degrees Fahrenheit.
C) to their lowest point on December 13.
D) to 10 degrees Fahrenheit and stay there for months.

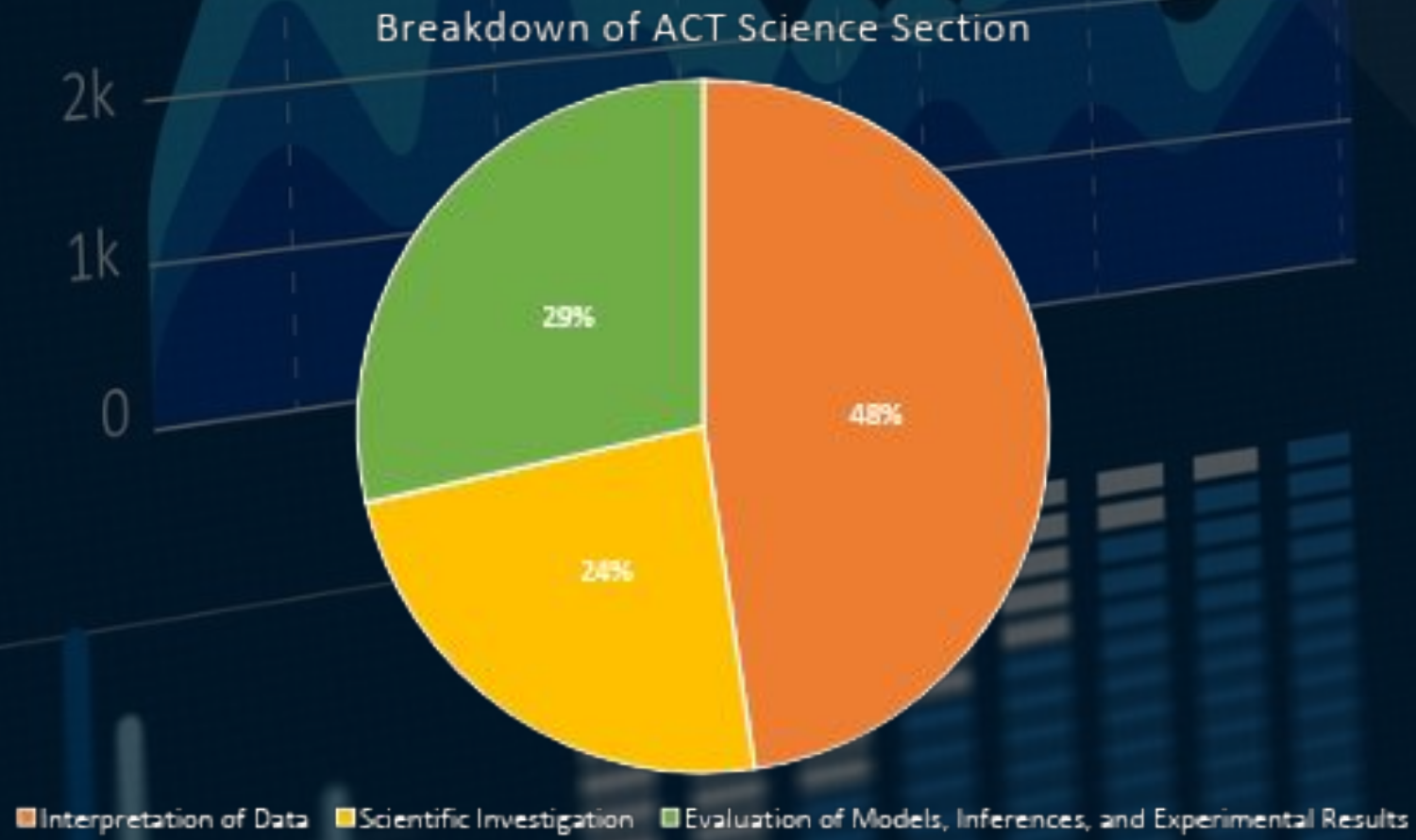
Average Daily High and Low Temperatures Recorded at Nuuk Weather Station, Greenland (1961—1990)



Adapted from WMO. ©2014 by World Meteorological Organization.

12% of the SAT Reading sections and **7%** of the Writing and Language sections require data skills

For the ACT, Data Analysis and Interpretation Are an Even Bigger Component



Source: http://www.act.org/content/act/en/products-and-services/the-act/test-preparation/description-of-science-test.html

Join us and Make the Necessary Change

Data Science is Not a Subject for Some. It is a Set of Skills for All.

RADICAL
INNOVATION
FOR
SOCIAL
CHANGE