THE M IN STEM

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WHY SHOULD STEM MATTER TO MATH TEACHERS?

JOBS

MONEY
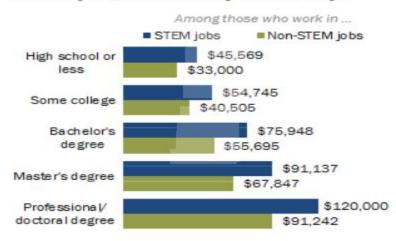
OPPORTUNITY

COMMUNITY

STEM jobs provide higher average earnings, no matter the education level.

STEM workers tend to earn more than similarly educated non-STEM workers

Median annual earnings of full-time, year-round workers ages 25 and older with positive earnings

Among those who work in ...
- ■ STEM jobs
- ■ Non-STEM jobs

Education level	STEM jobs	Non-STEM jobs
High school or less	$45,569	$33,000
Some college	$54,745	$40,505
Bachelor's degree	$75,948	$55,695
Master's degree	$91,137	$67,847
Professional/ doctoral degree	$120,000	$91,242

Note: Figures based on 2016 dollars. Some college includes those with an associate degree and those who attended college but did not obtain a degree. Professional degree includes those with an M.D., DDS, DVM, LL.B. or J.D. Doctoral degree includes those with a Ph.D. or Ed.D. STEM stands for science, technology, engineering and math.

Source: Pew Research Center analysis of 2014-2016 American Community Survey (IPUMS).
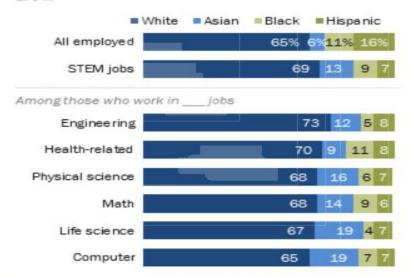
"Women and Men in STEM Often at Odds Over Workplace Equity"

PEW RESEARCH CENTER

Blacks and Hispanics underrepresented across most STEM job clusters

% of employed adults in each occupational group who are ...

Legend: ■ White ■ Asian ■ Black ■ Hispanic

	White	Asian	Black	Hispanic
All employed	65%	6%	11%	16%
STEM jobs	69	13	9	7

Among those who work in ____ jobs

	White	Asian	Black	Hispanic
Engineering	73	12	5	8
Health-related	70	9	11	8
Physical science	68	16	6	7
Math	68	14	9	6
Life science	67	19	4	7
Computer	65	19	7	7

Note: Based on employed adults ages 25 and older. Whites, blacks and Asians include only non-Hispanics. Hispanics are of any race. Other and mixed race non-Hispanics are not shown. Engineering includes architects. STEM stands for science, technology, engineering and math.
Source: Pew Research Center analysis of 2014-2016 American Community Survey (IPUMS).
"Women and Men in STEM Often at Odds Over Workplace Equity"

PEW RESEARCH CENTER

Minorities make up a smaller percentage of the overall STEM workforce.

Pew: http://www.pewresearch.org/fact-tank/2018/01/09/7-facts-about-the-stem-workforce/

Women make up just over 20% of engineering undergrad degrees.

	Male 79.2%	Female 20.8%

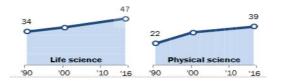|	2007	2008	2009	2010	2011	2012	2013	2014	2015
Female	18.1%	18.0%	17.8%	18.1%	18.4%	18.9%	19.1%	19.9%	19.9%
Male	81.9%	82.0%	82.2%	81.9%	81.6%	81.1%	80.9%	80.1%	80.1%
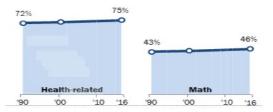
Fewer women are employed in computer science jobs.

Engineering and the physical sciences remain majority male.

Women's representation in computer jobs has declined since 1990

Share of employed adults in each occupational group who are women (%)

Health-related: 72% ('90) — 75% ('16)
Math: 43% ('90) — 46% ('16)
Life science: 34 ('90) — 47 ('16)
Physical science: 22 ('90) — 39 ('16)
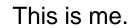Computer: 32 ('90) — 25 ('16)
Engineering: 12 ('90) — 14 ('16)

Note: Based on employed adults ages 25 and older. Engineering includes architects.
Source: Pew Research Center analysis of 1990 and 2000 decennial censuses and 2014-2016 American Community Survey (IPUMS).
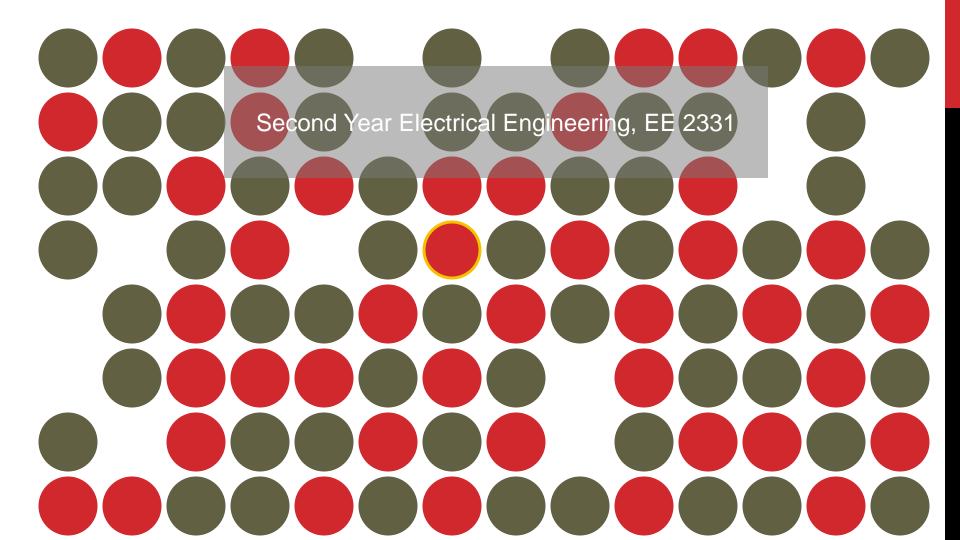"Women and Men in STEM Often at Odds Over Workplace Equity"
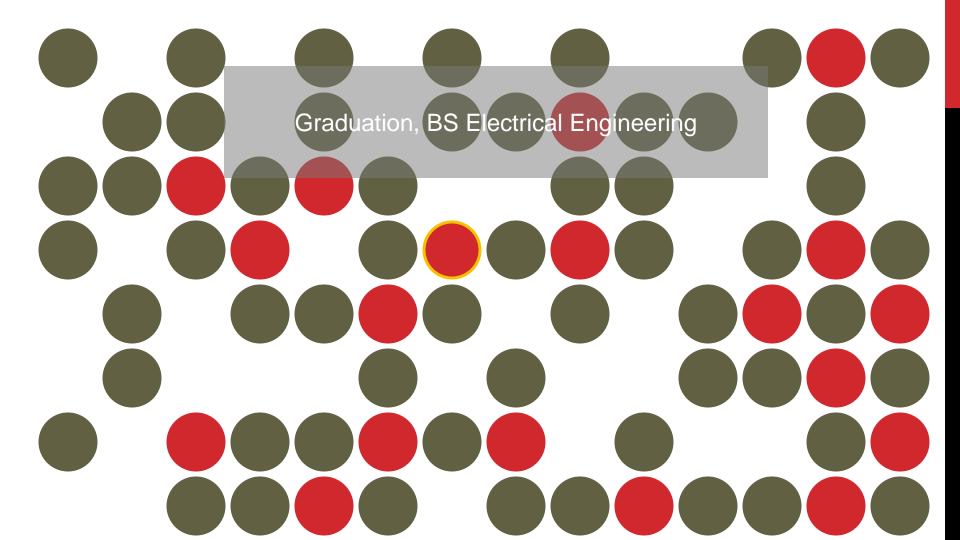
WHY DO I CARE ABOUT STEM?

This is me.

Engineer. Not an artist.

First Year Electrical Engineering, EE 1304

Second Year Electrical Engineering, EE 2331

Graduation, BS Electrical Engineering

Graduation, MS Electrical Engineering

WHY DO STUDENTS DROP ENGINEERING?

- Discouraged by teachers, peers, parents

- Social factors and stigmas

- It's hard…

- Lack math skills

Why do women leave engineering, MIT: http://news.mit.edu/2016/why-do-women-leave-engineering-0615

WHY DO GIRLS DROP ENGINEERING?

- **Discouraged by teachers, peers, parents**

- **Social factors and stigmas**

- **Desire for perfection**

- **Gender dynamics**

- **Disillusionment with career options**

Why do women leave engineering, MIT: http://news.mit.edu/2016/why-do-women-leave-engineering-0615

YouCubed: https://bhi61nm2cr3mkdgk1dtaov18-wpengine.netdna-ssl.com/wp-content/uploads/Youcubed-STEM-white-house.pdf

WHY ENGINEERING?

- Lots of beautiful math!

- Finally, an application that meant something!

- Problem-solving

- There's always a better way

Other reasons…

- Higher pay

- Job prospects

- Interesting, leading edge innovation

- More careers require analytical thinking and skills

Industry 4.0

Health care

Smart cities

Autonomous transportation

WHAT YOU CAN DO

Teach perseverance

Encourage failure (be willing to do so yourself)
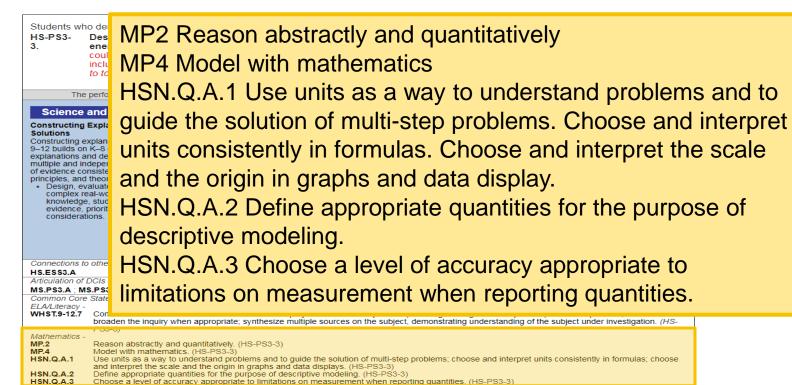
Give girls leadership roles on projects

Bring applications into your classroom

Show students that math isn't just a series of steps

Expose students to ways people use math in their careers

Talk to the science department – they have cool toys

SPEAKING OF SCIENCE...

MP2 Reason abstractly and quantitatively

MP4 Model with mathematics

HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems. Choose and interpret units consistently in formulas. Choose and interpret the scale and the origin in graphs and data display.

HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Students who de...
HS-PS3-3. Des... ene... coul... inclu... to to...

The perfo...

Science and

Constructing Expla... Solutions
Constructing explan... 9–12 builds on K–8 ... explanations and de... multiple and indep... of evidence consist... principles, and theor...
• Design, evaluat... complex real-wo... knowledge, stud... evidence, priori... considerations.

Connections to othe...
HS.ESS3.A
Articulation of DCIs
MS.PS3.A ; MS.PS3...
Common Core State...
ELA/Literacy -
WHST.9-12.7 Con... broaden the inquiry when appropriate; synthesize multiple sources on the subject; demonstrating understanding of the subject under investigation. *(HS-PS3-3)*

Mathematics -
MP.2   Reason abstractly and quantitatively. (HS-PS3-3)
MP.4   Model with mathematics. (HS-PS3-3)
HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS3-3)
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS3-3)
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS3-3)

HS-PS3-3 Energy

NGSS: https://www.nextgenscience.org/pe/hs-ps3-3-energy

APPLICATIONS FROM CLASSROOM TO CAREER

Bridge building

Coding/ Computer Science

STEM Behind…

STEM TASK IDEAS TO TAKE HOME

TASK 1: COMPUTATIONAL THINKING

Write the "program" that would display the following…

1
2
3
4
5
6
7
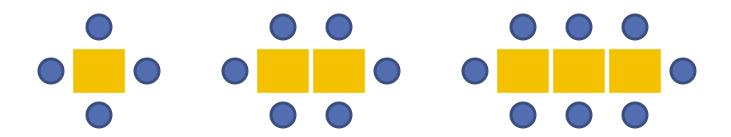
Compare steps. Can you make your "program" more efficient?

TASK 1:
IN YOUR CLASSROOM

Questions:

- **What is the fewest number of instructions you can give to create the same output?**

- **How many different ways can you get the same output?**

- **How could you change the prompt to make it more challenging?**

CODING TASK FOR MODELING

Write a program that will determine the number of seats that are possible at N tables.

How might you approach this problem?
Why might this be a good example to code?

CODING RESOURCES

10 MINUTES OF CODE

- **For TI calculators**

- **Beginner-friendly**

- **https://education.ti.com/en/activities/ti-codes**

HOUR OF CODE™

- **Multiple platforms**

- **For all levels/ ages**

- **https://hourofcode.com/us**

- **Activities, posters, videos, handouts**

TASK 2: BUILDING BRIDGES

Science: Predicting and measuring forces

Technology: Using sensors to collect real data
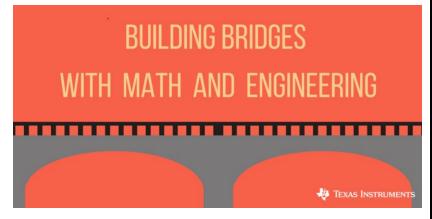
Engineering: Constructing a paper bridge

Math: Analyzing and interpreting results

https://bit.ly/2EFaI8c

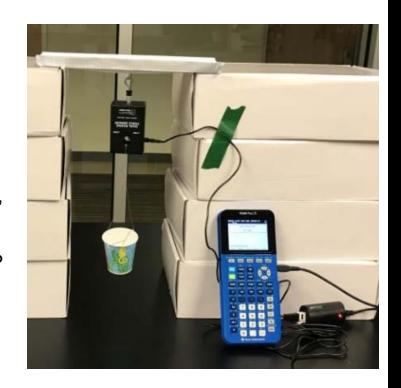https://education.ti.com/en/bulletinboard/2018/february/buildingbridgesmath

TASK 2:
IN YOUR CLASSROOM

Activity: Plot your data, Newtons vs. number of washers

- What does slope represent?

- What about the Y-intercept? What does it represent?

Extension: Plot your data, Newtons vs. "kg in the car"

- What does the slope of this relationship (kg, Newtons) represent? Could you have guessed it?

- Compare the y-intercept to the first model. Why do you think that happens?

TASK 3:
EXPLORE CAREER OPTIONS

STEM Behind Health

- https://bit.ly/2HvuPeE

- Medical research

- Nursing, physicians

STEM Behind Cool Careers

- https://bit.ly/2w4r3hF

- Fashion

- Mural painting

- Aviation/ pilots

- Ice cream making

This simulation encourages students to connect what they are learning in school to the authentic, relevant research that we are conducting now.

Camille Parker, BS
Lab Coordinator
The Sanford Project,
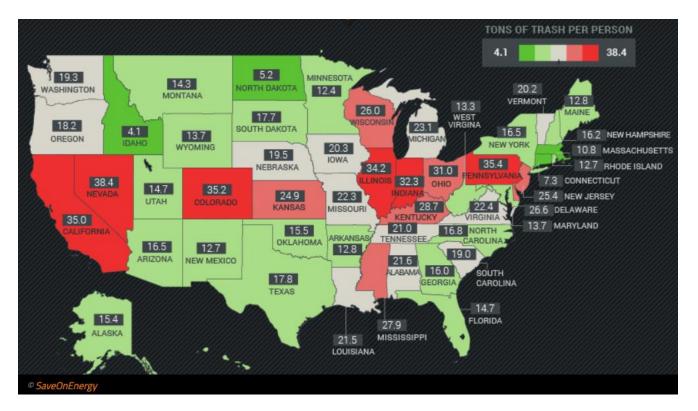Sanford Research

TASK 4:
A GARBAGE PROBLEM

Image: https://www.treehugger.com/environmental-policy/trash-numbers-startling-statistics-about-americans-and-their-garbage.html

TASK 4:
THE GARBAGE PROBLEM

Year	Population (millions)	Garbage (billions of kg)
1960	179	81
1965	190	99
1970	203	117
1975	214	122
1980	227	132
1985	238	145
1990	249	180
1995	262	208

A Math lesson
- Plot the data
- Find a relationship using a regression

Make it a STEM lesson
- Do the above and…
- Discuss observations
- Make predictions based on the data
- Design a plan to help deal with potential garbage problems every year and over a decade

MORE RESOURCES

Engineering Insight. Videos, infographic, FAQs and other resources for parents, students, counselors, administrators about electrical engineering.

http://www.ti.com/corp/docs/engineering-insight/index.html

NSF STEM Education Data.
https://nsf.gov/nsb/sei/edTool/

THANKS!!

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