THE M IN STEM

KELLY KUTACH
KKUTACH@TI.COM
@TIKELLYK

EDUCATION.TI.COM
@TICALCULATORS
WHY SHOULD STEM MATTER TO MATH TEACHERS?
JOBS

MONEY

OPPORTUNITY

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

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

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Female (%)</th>
<th>Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>18.1%</td>
<td>81.9%</td>
</tr>
<tr>
<td>2008</td>
<td>18.0%</td>
<td>82.0%</td>
</tr>
<tr>
<td>2009</td>
<td>17.8%</td>
<td>82.2%</td>
</tr>
<tr>
<td>2010</td>
<td>18.1%</td>
<td>81.9%</td>
</tr>
<tr>
<td>2011</td>
<td>18.4%</td>
<td>81.6%</td>
</tr>
<tr>
<td>2012</td>
<td>18.9%</td>
<td>81.1%</td>
</tr>
<tr>
<td>2013</td>
<td>19.1%</td>
<td>80.9%</td>
</tr>
<tr>
<td>2014</td>
<td>19.9%</td>
<td>80.1%</td>
</tr>
<tr>
<td>2015</td>
<td>19.9%</td>
<td>80.1%</td>
</tr>
</tbody>
</table>

Fewer women are employed in computer science jobs.

Engineering and the physical sciences remain majority male.

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 GIRLS DROP ENGINEERING?

- Discouraged by teachers, peers, parents
- Social factors and stigmas
- Desire for perfection
- Gender dynamics
- Disillusionment with career options

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
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
Exposé students to ways people use math in their careers
Talk to the science department – they have cool toys
**HS-PS3-3 Energy**

**NGSS**: [https://www.nextgenscience.org/pe/hs-ps3-3-energy](https://www.nextgenscience.org/pe/hs-ps3-3-energy)

### 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.

[Image of the page]
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

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

**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
- Medical research
- Nursing, physicians

STEM Behind Cool Careers
- https://bit.ly/2w4r3hF
- Fashion
- Mural painting
- Aviation/ pilots
- Ice cream making
TASK 4: A GARBAGE PROBLEM

TASK 4: THE GARBAGE PROBLEM

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (millions)</th>
<th>Garbage (billions of kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>179</td>
<td>81</td>
</tr>
<tr>
<td>1965</td>
<td>190</td>
<td>99</td>
</tr>
<tr>
<td>1970</td>
<td>203</td>
<td>117</td>
</tr>
<tr>
<td>1975</td>
<td>214</td>
<td>122</td>
</tr>
<tr>
<td>1980</td>
<td>227</td>
<td>132</td>
</tr>
<tr>
<td>1985</td>
<td>238</td>
<td>145</td>
</tr>
<tr>
<td>1990</td>
<td>249</td>
<td>180</td>
</tr>
<tr>
<td>1995</td>
<td>262</td>
<td>208</td>
</tr>
</tbody>
</table>

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.


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

Kelly Kutach
kkutach@ti.com
@TIKellyK
education.ti.com