



# STEM Education for FCS – Electrical Engineering Module

FEB 20, 2021 | ABI OLUKEYE | SMART GIRLS HQ

# ➤ TEAM SMART GIRLS HQ




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# Discussion Points

Current State of the STEM Workforce

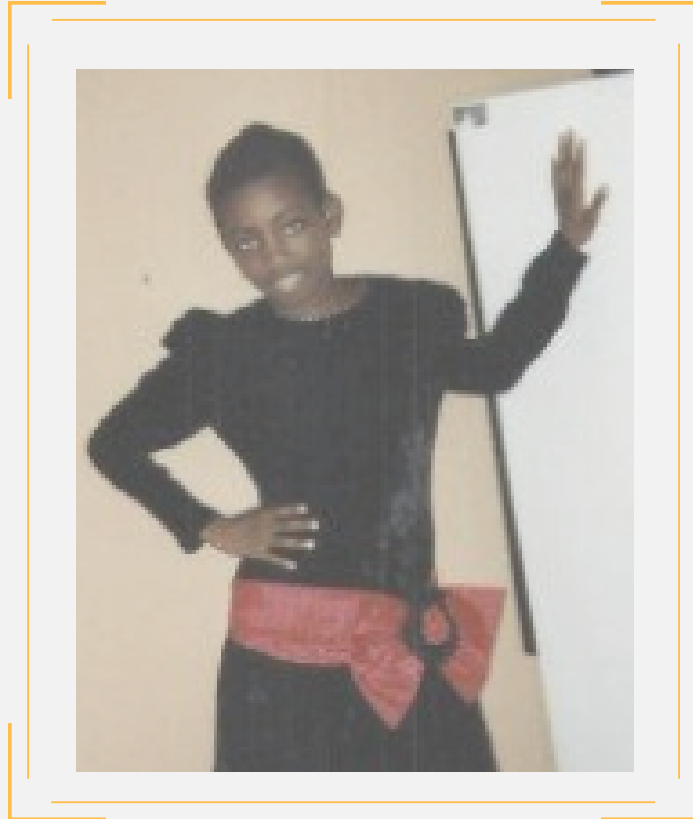
Why Close The STEM Gender Gap?

What We Know About Girls And STEM

Influential Perceptions About STEM And How To Change Them

Dear Smart Girl Kit Activity Session Breakouts

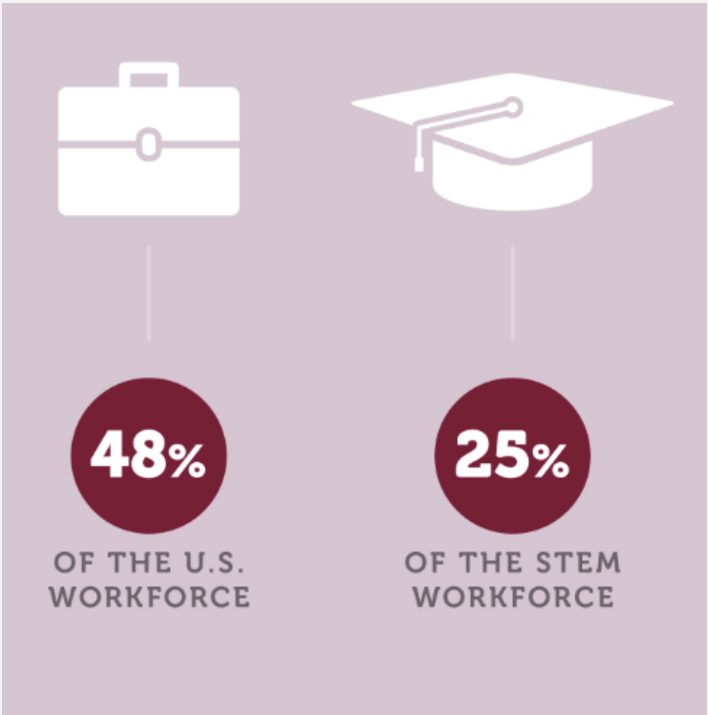




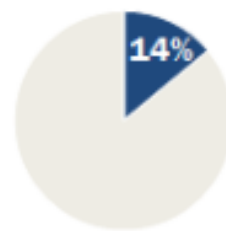
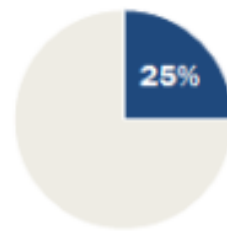
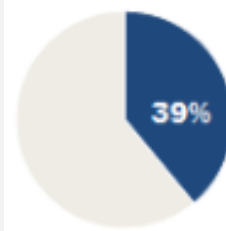
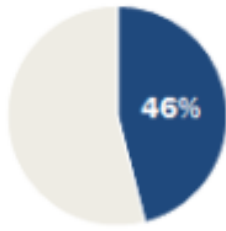
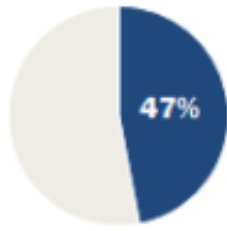
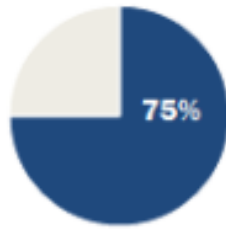
# BUT FIRST, A LITTLE ABOUT ME...

- Early STEM Influences
- First Exposure to Technology As A Career Path in HS
- Bias towards real world applications of technology
- 13 yr career in manufacturing solving business problems with technology
- 2 Daughters (aged 9 & 6)

# Current State of The STEM Workforce



Women are key participants in the labor market representing 57% of bachelors degree holders, 60% of masters level degrees and 48% of the workforce.



.. Except for with STEM Careers where they only represent 25% of the workforce. There haven't been significant growth in participation since the early 2000s

**Women in STEM have a bias toward physical and life sciences**

# Why Does This Matter?

## 1 STEM Talent Shortage

According to the Manufacturing Institute, Over the next decade nearly 3.5M\* manufacturing jobs will need to be filled and the skills gap is expected to result in 2M jobs going unfilled.

## 2 Economic Advantage

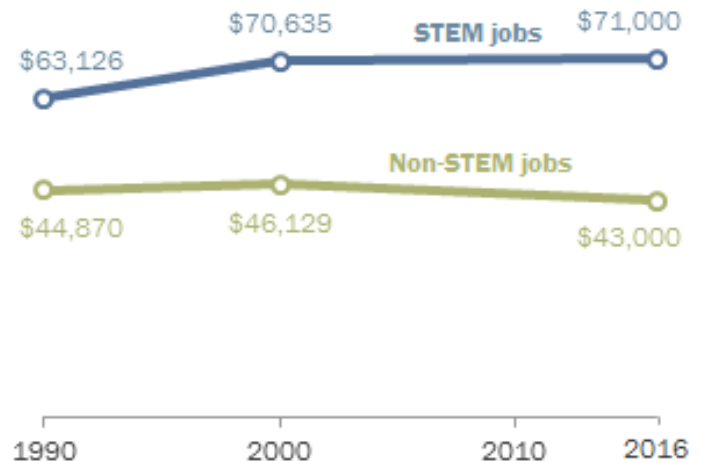
While women in the general workforce only make .73¢ to a man's \$1. Women in STEM actually make two thirds more than non-STEM workers including men. Also, women are 60%\*\* more likely to be the head of household; a higher earning power goes a long way.

## 3 Diverse Perspectives

STEM enabled innovations are often life changing. Women participating in solving problems, particularly those that impact them directly, allow for brilliant ideas and discoveries that haven't been considered before.

### The typical STEM worker now earns two-thirds more than non-STEM workers

Median annual earnings of full-time, year-round workers ages 25 and older, in 2016 dollars



Note: Based on adults ages 25 and older employed full-time year-round with positive earnings. STEM stands for science, technology, engineering and math.

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"

PEW RESEARCH CENTER

\* The skills Gap in US Manufacturing 2015 and beyond, Deloitte and The Manufacturing Institute

\*\*Organization for Economic Co-operation and Development

# **What Do We Know About Girls And STEM?**

**MYTHS VS FACTS**

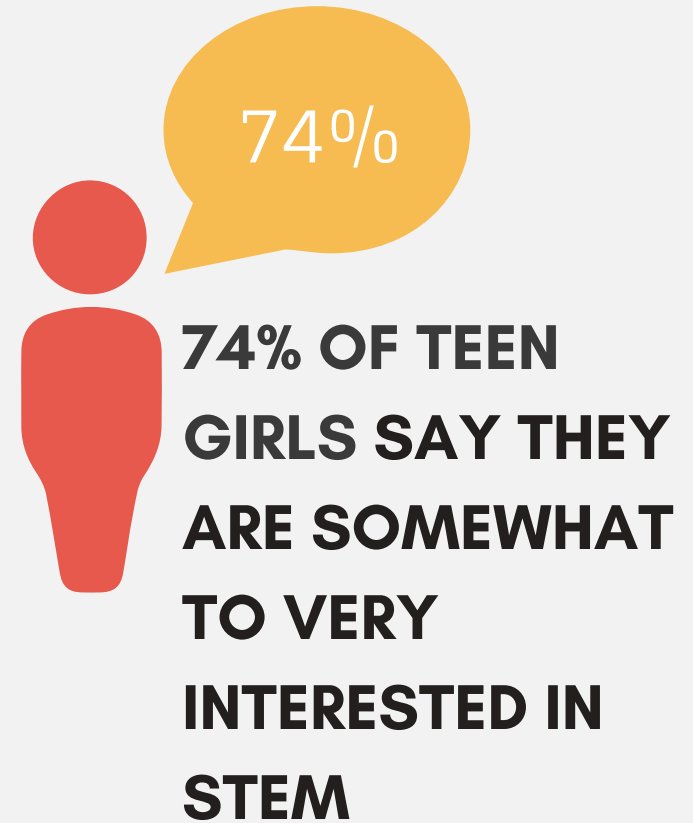




# MYTH #1:

# Girls Are Not Interested In STEM

% WHO AGREE...	STEM	NON-STEM
I like to understand how things work.	87	65
I like puzzles and solving problems.	85	70
I like doing hands-on science projects.	83	56
I like asking questions about how things work and finding ways to answer them.	80	54
I like to understand how the natural world works.	79	57
I like building things or putting things together.	67	47
I like to understand how things are built.	66	47
I like doing math problems.	65	32
I think it would be fun to create an iPhone app or design a computer/video game.*	62	57



# MYTH #2:

## Girls Are Not Built For The rigor of STEM



**90% OF TEEN GIRLS BELIEVE IF THEY TRY HARD AT SOMETHING, THEY WILL SUCCEED**

% WHO AGREE...	STEM	NON-STEM
Whatever boys can do, girls can do.	97	91
If I try really hard at something, I know I will succeed.	95	88
I'm a hard worker.	93	87
When someone tells me I can't do something, I try to prove them wrong.	94	89
Obstacles make me stronger.	91	85
I get frustrated if something is too hard.	79	86
I try to pursue things I'm naturally good at and avoid things that are hard for me.	66	79

# BURSTING THE MYTH: A Case Study



**Our Smart Girls Squad Program at Dorothy J Vaughn Academy of Technology, Charlotte , NC**

# **Rebranding *STEM* for Girls**

MYTH VS FACT: GIRLS ARE NOT INTERESTED

# PERCEPTION #1: STEM IS NOT CREATIVE

Most girls identify themselves as creative but don't think STEM jobs allow for creativity

% of girls (Grades 5 - 12) that think people in these STEM jobs get to be creative at their Job

COMPUTER SCIENTIST

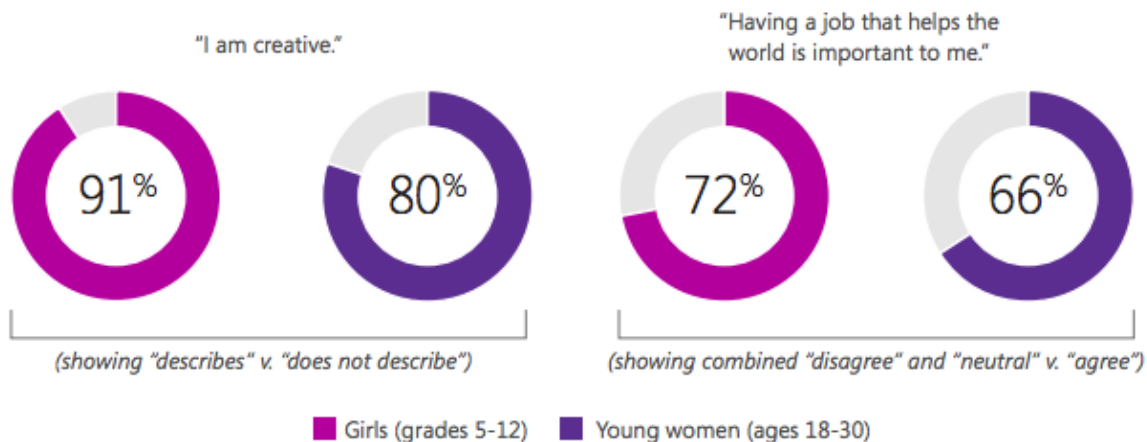
**44%**

ENGINEER

**49%**

MATHEMATICIAN

**19%**



# REALITY: STEM + CREATIVITY ENABLES INNOVATION



## How Can We Change Perceptions?

- Make STEM learning practical + interactive
- Demystify *making*
- Connect the dots from real world innovations and STEM contributions

"When I was in lower grades, it was pretty fun to do activities in science. When I got to 6th grade, we just had to do book work and question. Science wasn't my favorite anymore."

- preteen girl

% of girls (Grades 5 - 12) that think people in these STEM jobs get to be creative at their Job *after hearing a brief description of real world accomplishments*

COMPUTER SCIENTIST

**+17%**

ENGINEER

**+14%**

MATHEMATICIAN

**+24%**

# PERCEPTION #2: STEM IS NOT IMPACTFUL

For most girls, Engineering and Technology career paths are perceived not to align to their goals of helping people and making a difference in the world

## TOP 5 IMPORTANCE IN CHOOSING A CAREER PATH

- Helping people
- Making a difference in the world
- Helping those who are less fortunate
- Having input into how the job is done
- Making a lot of money

## TOP 10 INTERESTED IN PURSUING...

- Medicine/Healthcare
- Arts/Design
- Social Science
- Entertainment
- Communications/Media\*\*
- Physical/Life Sciences
- Community/Social Services\*\*
- Education\*
- Business/Finance
- Law

*If you think about teachers, everyone knows about teachers as a career, but not everyone our age really thinks about engineering.*

*They don't know all that much about it.*

*- preteen girl*

# REALITY:

## STEM SOLVES REAL WORLD PROBLEMS



### How Can We Change Perceptions?

- Go beyond "Hello World"
- Corporations should connect young people to their "Why" and "How"

Nearly two-thirds of women who work in STEM fields (64%) and tech (65%) *feel that the work they do makes a difference in the world*. This is 7 and 8 points higher than working women overall (57 percent)

% of girls (Grades 5 - 12) that think people in these STEM jobs make a difference in the world *after hearing a brief description of real world accomplishments*

COMPUTER SCIENTIST

**+33%**

ENGINEER

**+28%**

MATHEMATICIAN

**+32%**



# PERCEPTION #3: STEM IS NOT INCLUSIVE

When asked to describe a typical scientist, engineer, mathematician, or computer programmer, 30 percent of girls say that they envision a man in these roles. As do almost 40% of adult women -- and 43% of women in STEM and tech fields.

% WHO AGREE...	CAUCASIAN	AFRICAN AMERICAN	HISPANIC
Because I am female, I would NOT be treated equally by the men I studied/worked with if I pursued a career in STEM. <sup>1</sup>	38	50	41
Employers in the fields of STEM don't usually want to hire women. <sup>1</sup>	25	35	31
Because I am female, I would be treated like an outsider if I pursued a career in STEM. <sup>1</sup>	25	38	29
If I went into a career in STEM, I'd worry about sexual harassment in the work place. <sup>2</sup>	19	30	28

<sup>1</sup>African American higher than Caucasian

<sup>2</sup>African American higher than Hispanic, Caucasian

# REALITY:

## WOMEN ARE THRIVING IN STEM



### How Do We Change Perceptions?

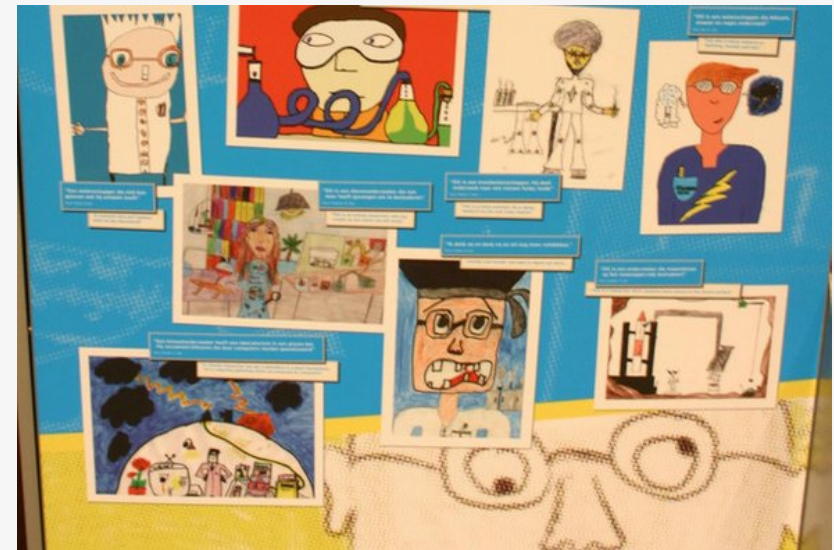
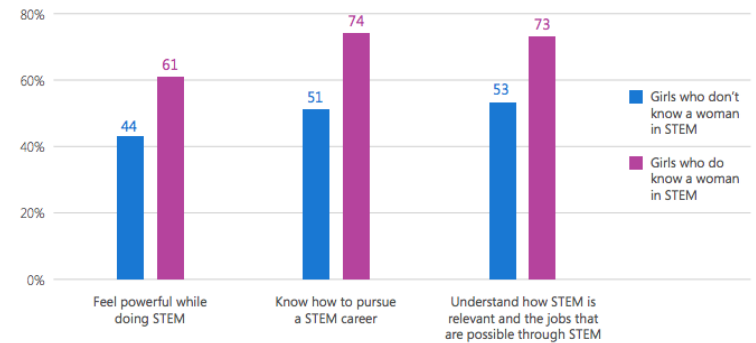
- Be persistent in showing female representation in STEM
- Go Beyond Traditional "Hero" Roles
- Corporations should engage girls earlier than college

*Majority (57%) of the women in Tech report that their employers made a strong effort to make an inclusive work environment.*

## #ILookLikeAnEngineer



What is the impact of female role models?  
Girls, Grades 5-12



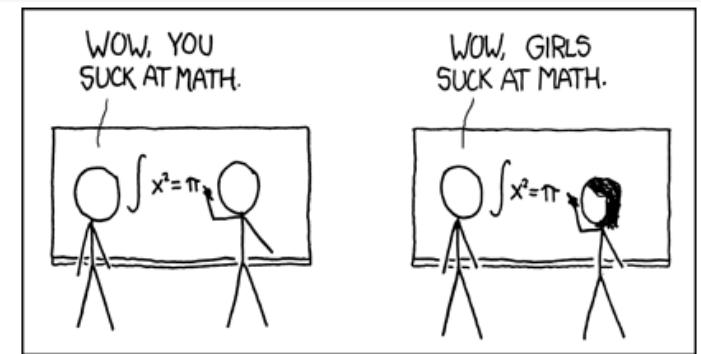
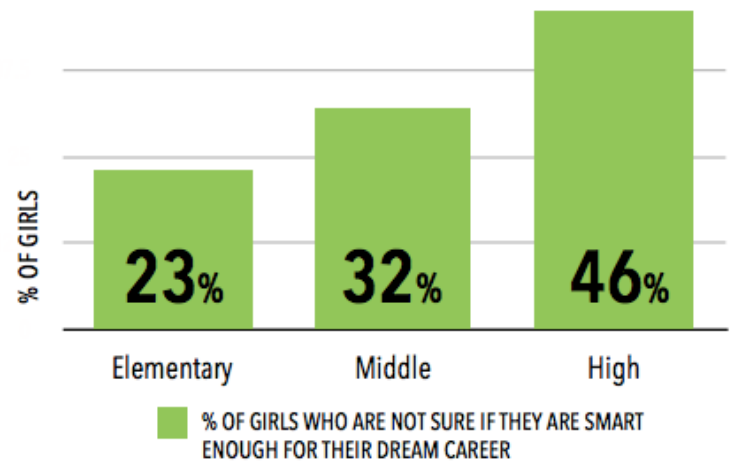
*Increased Female Representation in results from recent update to Draw-A-Scientist Study*

# PERCEPTION #4: STEM IS EASIER FOR BOYS

By Age 6, Girls think they are not as smart as their male peers.



GIRLS' PERCEPTIONS OF THEIR INTELLIGENCE also changes as they get older. In 5th grade, 23% of girls do not feel they are smart enough for their dream career, by high school this doubles to 46%.



# REALITY:

## STEM IS HARD FOR EVERYONE

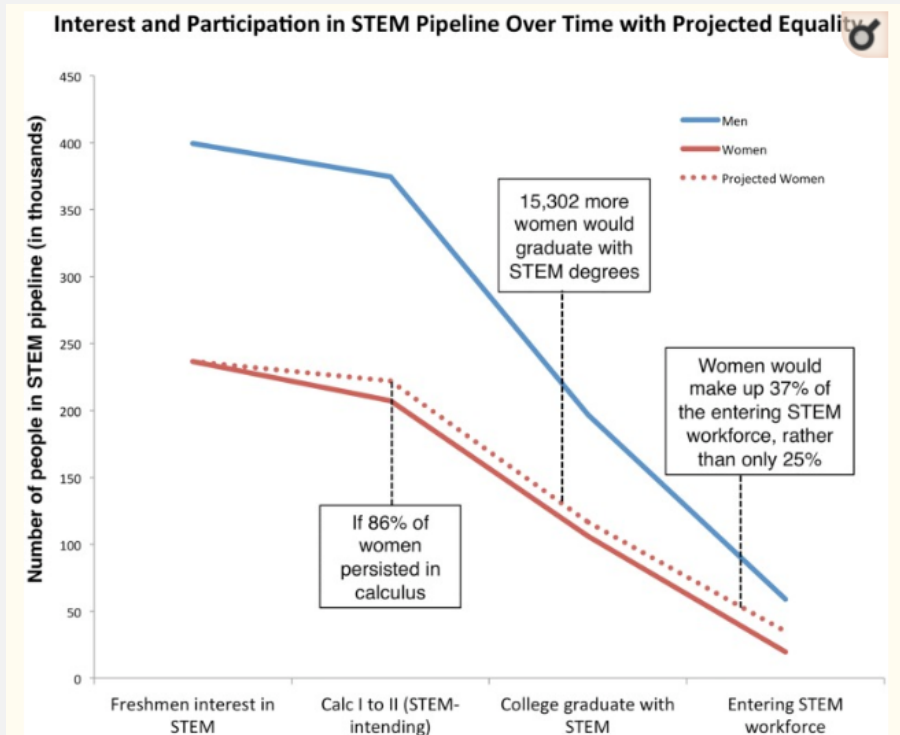
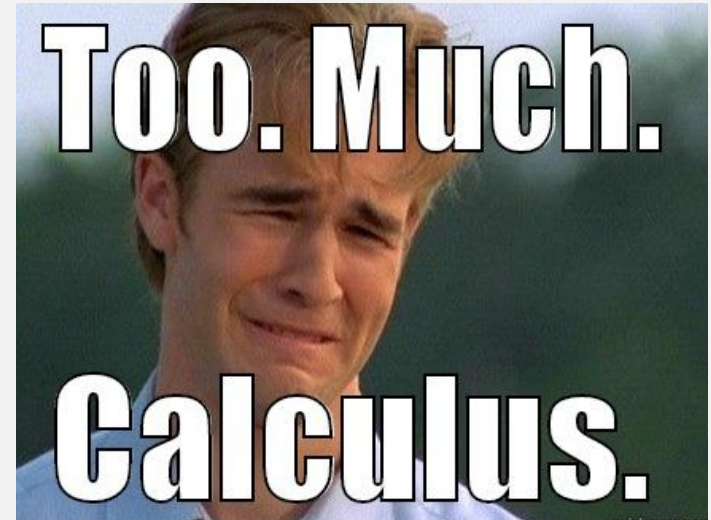


Fig.5  
Projected participation of STEM if women and men persisted at equal rates after Calculus I.  
The dotted line represents the projected participation of women.

Data Source: Research paper. Dr Ellis, Fr Bailey and Dr Rasmussen



Women would make up 37% of the STEM workforce rather than only 25% if they persisted at equal rates to men after Calculus 1

# REALITY CONT'D:

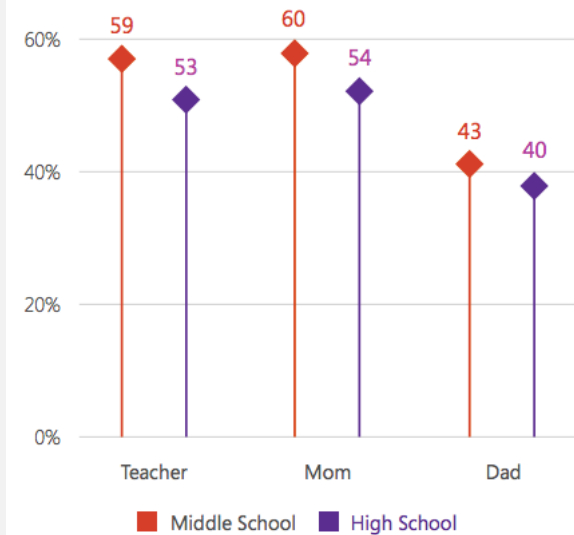


## How Do We Change Perceptions?

- Early Exposure is critical
- Enrichment and support are necessary
- Create STEM Advocates in schools and at home
- Stop Teaching Our Girls To Be Perfect

### Who encourages girls in STEM?

Girls, Grades 5-12



Teacher

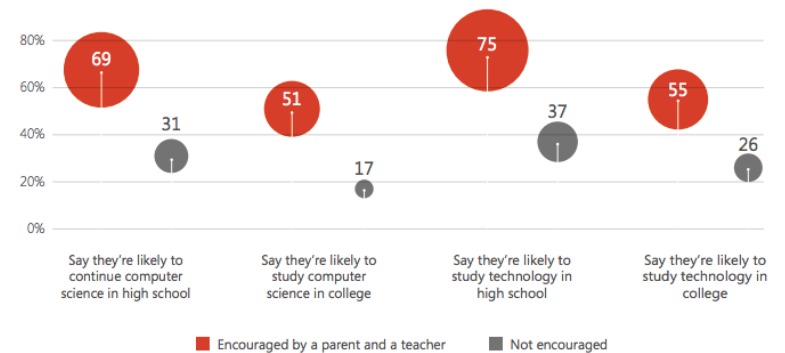
Mom

Dad

■ Middle School ■ High School

### What happens when support is combined?

Girls, Grades 5-12



Say they're likely to continue computer science in high school

Say they're likely to study computer science in college

Say they're likely to study technology in high school

Say they're likely to study technology in college

■ Encouraged by a parent and a teacher ■ Not encouraged

Reshma Saujani:

## Teach girls bravery, not perfection

TED2016 · 12:39 · Filmed Feb 2016

2 subtitle languages

View interactive transcript





# Key Takeaways

Girls start off very interested in STEM but lose interest over time due to unfavorable perceptions about STEM.

These perceptions can be change through specific actions.

## 4 ACTIONS TO TAKE TO BETTER ENGAGE GIRLS IN STEM

- **Connect the dots** between innovation, creativity and STEM through practical learning experiences
- **Show STEM Impact** by engaging her in why and how your products or services make a difference in the world around her.
- **Make role models more visible**, work places more inclusive, and her path to career clearer.
- **Empower her to stick with it**; enrich her learning in ways that bring STEM to life.

# IT TAKES A VILLAGE ...

Let's Work Together To Create Pathways For Girls To Succeed At STEM

## SMART GIRLS HQ

Our mission is to increase female participation in the STEM talent pipeline for K - 12 girls. We do this in partnership with ...

### **PARENTS:**

by providing content, tools, and resources that empower them to inspire and sustain STEM interest beyond the classroom.

### **EDUCATORS:**

To create learning tools that bring STEM to life and help connect the dots to STEM career paths.

### **CORPORATIONS:**

To connect girls in the communities they serve to the positive impact of their products and services and to the STEM careers that help make it happen.

## RAISING SMART GIRLS.COM

### **Online Destination for Parents of Girls**

*Highly adaptive digital library of editorial content, tools, and resources. We aim to help parents of girls aged 3 to 12 develop competence, confidence and character.*

### **Personalized Service**

*An app that uses artificial intelligence to deliver just-in-time recommendations of STEM inspired resources that match their daughter's unique interests.*

### **Offline STEM Experiences**

*Local hands on interactive sessions that engage girls in maker fun that is inspired by their interests and connects to dots to real life career paths.*

Join our community of over 20k Parents on Facebook and Subscribe to our weekly newsletter @ [RaisingSmartGirls.com](https://RaisingSmartGirls.com)



[abieSmartGirlsHQ.com](mailto:abieSmartGirlsHQ.com)



Abi Olukeye



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# DEAR SMART GIRL

A STEM CAREER  
LITERACY  
CURRICULUM  
PERFECT FOR AGE

8+

DESIGN AND LIGHT UP A  
HEAD BAND WITH  
PARALLEL CIRCUITS!

01  
ENGINEER  
SERIES

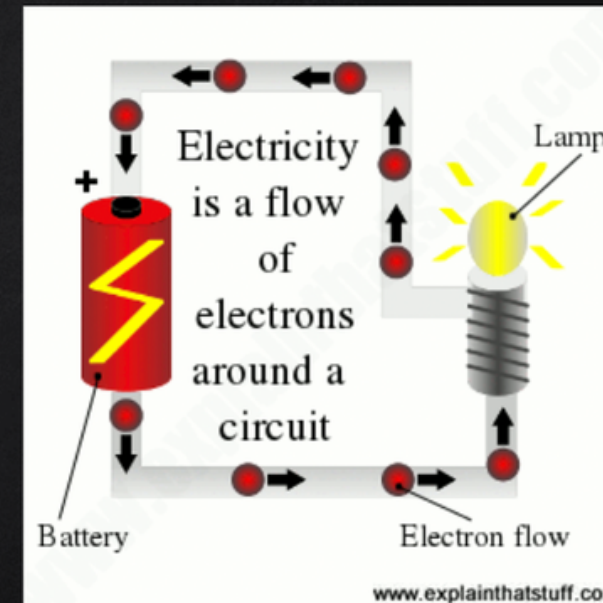
WARNING: CHOKING HAZARD - SMALL PARTS NOT FOR CHILDREN UNDER AGE 3





# WHAT IS ELECTRICITY?

- ✘ To make electricity, you must have **electrons**
- ✘ Electrons are a tiny charged part of an atom
- ✘ When a stream of electrons move through a conductor, you get electricity.
- ✘ A conductor is anything that allows the flow of electrons to go through it.
- ✘ Materials such as copper metal that allow electricity to flow through them readily are **conductors**, others like plastic and rubber that don't are called **resistors**.

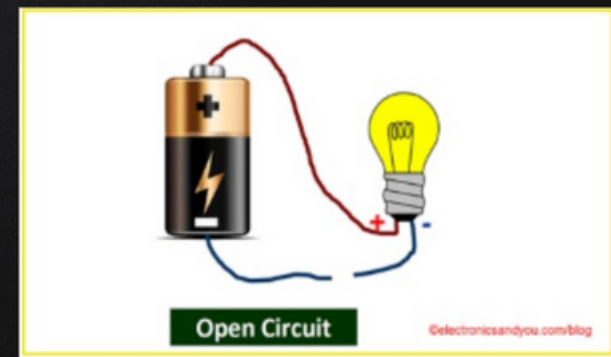
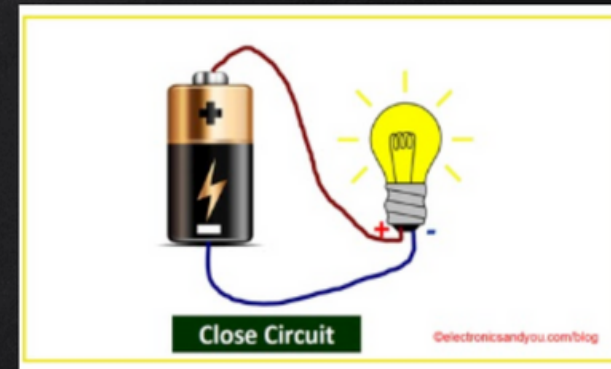


Fun Fact: Back in the days, people used to think electricity was a kind of fire.



## WHAT IS A CIRCUIT?

- ✗ Electrons have to travel and they do so in an **electrical circuit** kind of like running around on a circular track.
- ✗ The path of a circuit has to end where it started with no gaps. This is called a **closed circuit**.
- ✗ If there is a gap, the electrons can't continue so the circuit is broken. This is called an **open circuit**.
- ✗ Electric current provides energy to power lots of things in our daily lives, from microwaves to your phone.



Fun fact: The word circuit comes from the Latin circuitus, which means to go around



# UNDERSTANDING OUR LIGHT UP HEADBAND CIRCUIT



## Lithium Battery

Low volt battery. Safe for experimentation.



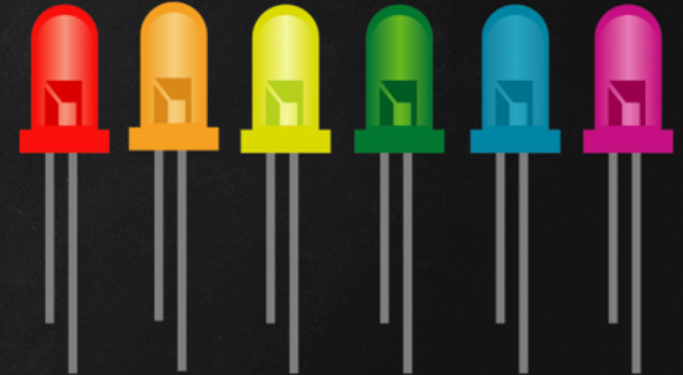
## Lily Pad

Battery holder with conductive surface area



## Conductive Thread

Thread that can carry current the way wires do.



## Light Emitting Diodes (LEDs)

A light source that emits when current flows through it.

Longer legs: positive

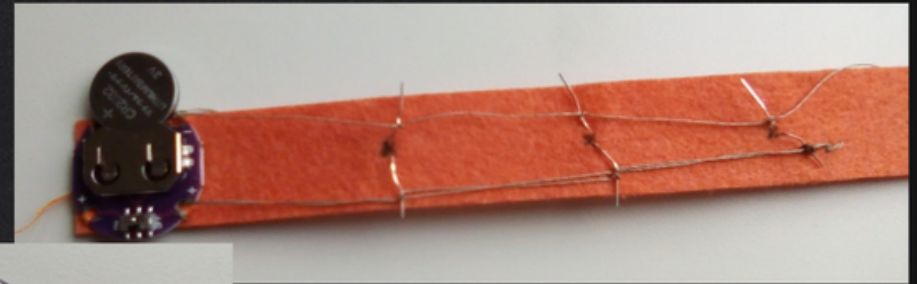
Shorter legs: negative



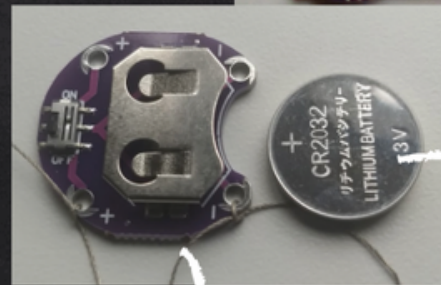
# UNDERSTANDING OUR LIGHT UP HEADBAND CIRCUIT



The thread and the surface area on the LilyPad act as **conductors**. It also has a **circuit breaker** to turn the light on and off



The **battery** is our power source.



**LEDs** are our light source.