

PULL



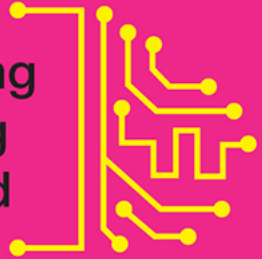
DON'T



PUSH



Why **STEM** Messaging  
to Girls Isn't Working  
& What to Do Instead



JULIE NEWMAN



# **PULL DON'T PUSH**

**Why STEM Messaging  
to Girls Isn't Working  
and What to Do Instead**

**JULIE NEWMAN**



**LIONCREST**  
PUBLISHING

**COPYRIGHT © 2023 JULIE NEWMAN**

All rights reserved.

**PULL DON'T PUSH**

*Why STEM Messaging to Girls Isn't Working and What to Do Instead*

**ISBN 978-1-5445-1899-2 Hardcover**

**978-1-5445-1898-5 Paperback**

**978-1-5445-1897-8 Ebook**

**978-1-5445-3164-9 Audiobook**

# CONTENTS

Introduction .....	1
<b>PART 1: THE INFORMATION PROBLEM .....</b>	<b>13</b>
1. What Got Us Here Won't Get Us There .....	15
2. Alphabet Soup.....	25
3. What Engineering Actually Is .....	43
4. The Culture of Victimhood .....	59
<b>PART 2: ENGINEERING HAS WHAT GIRLS WANT—SO TELL THEM .....</b>	<b>75</b>
5. Money and Stability .....	77
6. Helping People and Collaborating .....	87

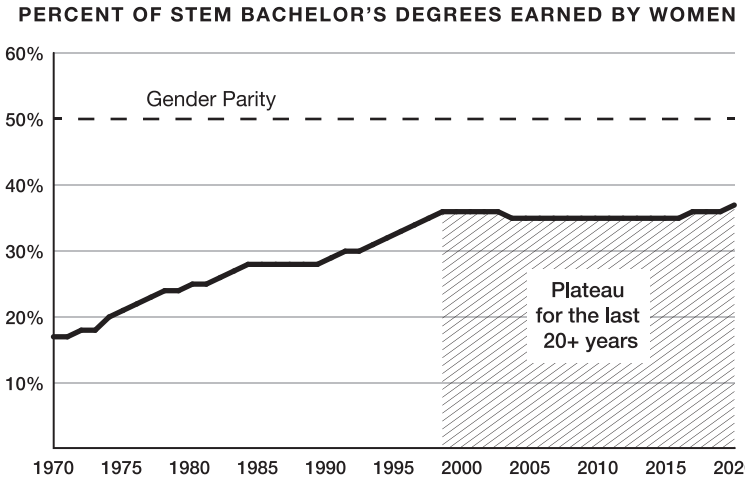
<b>7. Work-Life Balance and a Fast Track .....</b>	<b>97</b>
<b>8. Creativity and Fulfillment.....</b>	<b>107</b>
<b>Conclusion .....</b>	<b>117</b>
<b>We're Not Done Yet—Keep Going!.....</b>	<b>125</b>
<b>APPENDICES .....</b>	<b>127</b>
<b>Appendix A: Ambassadors 101 .....</b>	<b>129</b>
<b>Appendix B: Outreach Event Tips.....</b>	<b>163</b>
<b>Appendix C: Outreach &amp; Engineering FAQs .....</b>	<b>221</b>
<b>References.....</b>	<b>243</b>
<b>Acknowledgments .....</b>	<b>251</b>

*To the girls who will engineer the future*

# INTRODUCTION

YOU AND I HAVE SOMETHING IN COMMON. WE BOTH WORK diligently to get more girls excited about pursuing careers in science, technology, engineering, and mathematics (STEM). We come at it from different angles. I'm in engineering and you're involved with education, outreach, or engagement. But we are both passionate about this work—which is why you've got to be as devastated as I am when you hear that the percentage of women earning degrees in STEM fields did not increase between 1998 and 2020.<sup>1</sup> Growth is stagnant. The numbers have plateaued. We are not doing enough to pull girls in—and in some cases we are actually pushing them away.

## PULL DON'T PUSH



There is some good news: Women are now earning more than half of all bachelor's degrees in the sciences, and a little less than half in math.<sup>2</sup> This is great and deserves congratulations. In this regard, the encouragement young women have received to study science and math has paid off!

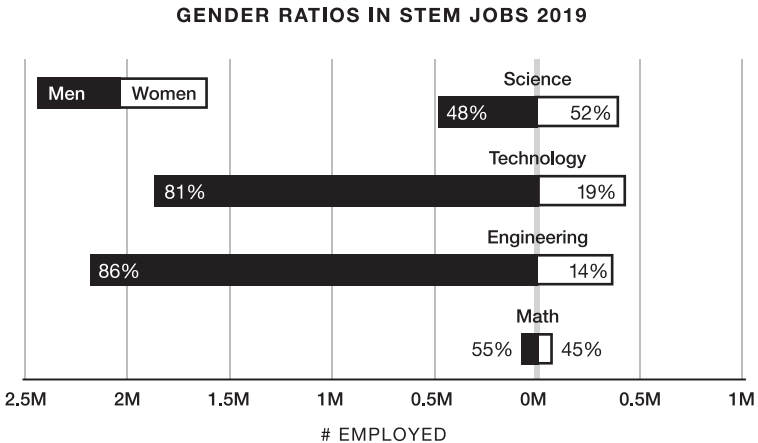
Now, the bad news: women earn only about 20% of bachelor's degrees in engineering and technology-related majors.<sup>3</sup> We have not achieved the same gains in engineering and technology as we have in science and math.

Today, all of your hard work and effort is only maintaining the status quo.



## Introduction

Now, the really bad news: these numbers are actually worse than they seem. The math and science fields combine for only about a fifth of all jobs available in STEM fields. There are more than twice as many engineering jobs in the American market than there are in science and math put together.<sup>4</sup> That means that even reaching parity, or close to it, in science and math degrees still couldn't put very many women into the STEM workforce. As of 2019, 86% of engineering jobs were still filled by men.



The outreach you did in the past got us where we are. And that's good. But what got us here won't get us where we need to be. We have to work smarter, not harder.

## PULL DON'T PUSH

You're driven to inspire kids, and you're dedicated to getting more girls interested in STEM. However, if you're anything like my other friends in outreach, you're also overworked, underfunded, and flying by the seat of your pants. You're giving your blood, sweat, and tears in exchange for only minimal gains.

So, what's happening? How is it that so many people like you can be putting in so much effort while barely making a dent in the national statistics?

For starters, there's no guidebook for how to do any of this. Instead of creating programs and events that follow any sort of philosophy or methodology, organizers often do what everyone else does, without knowing why. The whole point of STEM outreach is to help girls learn about their career options in these fields. Unfortunately, the career option with the most jobs<sup>5</sup> available and the highest average salary<sup>5</sup>—engineering—often goes unmentioned.

Here lies the key to putting more women in STEM: encourage them to pursue engineering. If we reach gender parity in the field of engineering, we could add upwards of 1.5 million women into the American STEM marketplace—1.5 million! That's fifty new female engineers for every existing female biologist.<sup>6</sup> And, the field of biology has already reached gender parity in the workforce.

The path for more girls to enter STEM is through engineering's door. But I'm not surprised that so few young women

## Introduction

follow this path. They don't know about it! Engineering is not taught in school, and it's barely covered at outreach events, if mentioned at all.

When I talk to educators and outreach coordinators, I often hear the same thing: they don't know how to sell engineering to kids because they literally don't know what engineers do. I get it—it's a big and confusing field. But if you all don't know anything about it, then it's no wonder girls don't either! Two-thirds of teenagers, according to a 2011 study, have never even considered a career in engineering—with the leading reason being that they were simply unfamiliar with the field. But then, after the group was exposed to information about the field, more than half of them said they were now more interested.<sup>7</sup>

What we have is a marketing and information problem. That's great news! A marketing and information problem is vastly easier to solve than any other type of problem. It doesn't require overhauling society to solve it. More importantly, it doesn't require changing the girls we're trying to reach. We just need to focus our message on giving girls the information they need.

That's where I come in.

## MY PATH TO STEM AND TO OUTREACH

I am an engineer, and I love my job. While growing up I had a whole slew of interests (just like most girls). Still, looking

## PULL DON'T PUSH

back at the behaviors I exhibited and the activities I pursued, it's shocking that no one ever really suggested that I choose engineering.

In middle school, I started participating in the Science Olympiad competition. I built model airplanes and rockets. I made robots and balsa wood bridges. It was all engineering work, yet no one was calling it that. In fact, I don't think I applied the word engineering to my natural talents and interests until I was picking out my college major. But if I had benefited from the kind of engineering-focused STEM outreach that I advocate for in this book, that realization would have been glaringly obvious to me by then!

I studied electrical engineering at the California Institute of Technology (Caltech), and spent my summers doing research and internships—including at SpaceX, where I helped develop electronics for the Falcon 9 rocket. In 2014, I graduated with my bachelor's degree and an eagerness to make a difference in the world.

After college, I found my first dream job at the NASA Jet Propulsion Laboratory (JPL)—where I extended my impact to outer space, too. JPL is best known as being the NASA center primarily responsible for the robotic exploration of the solar system. If you've heard of rovers driving around on Mars, you've heard of JPL.

## Introduction

When I joined the team, I first worked on an earth satellite project as part of an effort to refine our climatology models by measuring ocean height at a centimeter scale across the entire world. After that, I designed the radar instrument for the Europa Clipper Mission, which will measure ice on the surface of one of Jupiter's moons, Europa, to help the search for alien life. After the hardware I designed was finally built—the electronics that will one day be operating 500 million miles from Earth—the feeling of holding it in my hands was indescribable.

After that project, I found my next dream job working as a project manager on the Space Launch System (SLS) at Boeing. The rocket, developed for NASA, is the most powerful launch vehicle ever flown and will provide the foundation for human exploration beyond Earth's orbit. The next astronauts to land on the moon and the first astronauts to step foot on Mars will be there because of the Space Launch System. I am amazed each day that, as an engineer, I am contributing to the forward progress of humanity—and getting us one step closer to reaching for the stars with our own hands.

I consider myself lucky to have found engineering—literally. I could easily have never found the field, something I often discuss with other women engineers, who agree with the sentiment. Not only do I think about girls who would love my job if they only knew to pursue it—I also think about women my age and older who would have loved my job, but never had a happy accident or impressionable interaction lead them here.

## **PULL DON'T PUSH**

These are the women I'm fighting for. My work fills me with wonder. I can say with absolute certainty that I will never leave this field, and I want other girls to experience the same fulfillment. As soon as I graduated from high school, I started volunteering with Science Olympiad. After I graduated from college, I also started participating in K-12 STEM outreach. I speak at events, give kids tours of where I work, and am instrumental in numerous programs designed to help girls interface with professional women in STEM.

During that time, I've seen a lot of what works and what doesn't. This is what sparked my desire to help outreach coordinators work smarter instead of harder—and what ultimately led me to write this book.

## **WHAT YOU'LL LEARN**

This is a targeted, research-based guidebook tailored to the needs of today's STEM outreach efforts to girls—based on what works and what girls say they want in a career.

In Part 1, I'll tell you more about the marketing and information problem inherent in STEM outreach and why an emphasis on engineering is the answer. Then, I'll explain exactly what engineering actually is so you can easily share soundbites with curious girls. Next, I'll teach you about the culture of victimhood, the number-one thing STEM events

## Introduction

do wrong, which actually scares girls away—not only from engineering but from any type of career in STEM.

Then, in Part 2, I'll break down exactly how to explain engineering to girls in a way that gets them excited and engaged. I've organized the advice based on the results of several surveys and studies, which outline what girls have already told us they want out of a career. Literally all of it is offered in engineering.

Finally, the appendix is full of handy templates, how-to's, and references. This is where you'll find tactics to implement the strategy. Here are guides to help you easily secure more appropriate guest speakers, utilize them to the fullest, and keep them coming back to volunteer year after year. Using these tips and references will guarantee your programming is effective.

Throughout, I'll highlight ways you may unknowingly—and unintentionally—be pushing girls away. I already mentioned the culture of victimhood. There are also several myths that scare girls off—for example, that all STEM jobs involve a lot of math and that all STEM jobs require years of grad school (and the debt it accrues).

We are on the same team. I am passionate about getting girls into STEM because it changed my life. And I am passionate about engineering because it is the exciting, rewarding, and fulfilling field in which I work.

## PULL DON'T PUSH

The goal is not to force girls into STEM, but to set them up to be able to make their own decisions—which they can't do if they don't have all the information. This book is not a pile of statistics or a rant about what we're doing wrong. It is solution-oriented. It's an optimistic collection of small things you can do to get big results. It is a tool to focus your own efforts and help you advocate for the changes you want to implement within your school or program. It is a way to help you pull, not push.

We are always telling girls to follow their passions. However, they can't feel passion for something they know little about. We have to start telling them more about engineering. First and foremost, doing so is a service to girls. I've done the research into what girls say they want. I'm so certain they will get excited about engineering that I believe it would be a disservice *not* to tell them.

Second, of course, attracting more young women to STEM benefits these fields by inserting more diversity of ideas and experience. I'm eager to put more engineers *total* out into the world because that's how we get to the future we want even faster. We can do that by drawing more women into the engineering field.

Finally, I have focused on engineering because E is the letter in the STEM acronym where we can see the most growth. It's where the majority of STEM jobs are, but where few women



## **Introduction**

are yet. By focusing more of our outreach on engineering, we could double the total number of women in STEM. And you won't have to coerce girls or convince them. There's no need to sell them—just tell them.