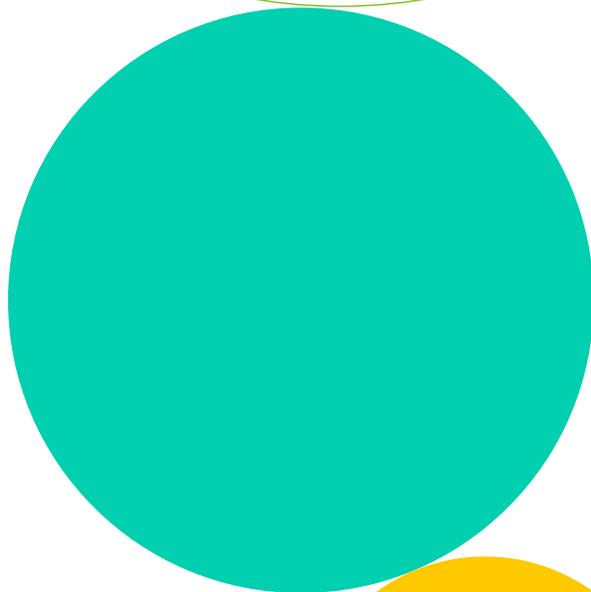


# Catalyzing Next-Gen STEMinists

Addressing confidence and motivational  
factors that hold women back from  
STEM careers





# I'm a self-proclaimed "girl geek," and proud of it.

But why am I still in the minority? Where are all the women pursuing STEM careers? Now more than ever, as citizens of the world deal with a global pandemic, we desperately need more STEM professionals – scientists, researchers, healthcare workers – to find solutions to life-altering problems. But our pool of potential STEM candidates is sorely missing women.

When my peers and I interview candidates, we don't see enough women applying for these technical roles. Even when I attend conferences, in person or remotely, the ratio of men to women is still far too distant.

I think one of the answers to those complicated questions is pretty simple: A lack of role models. Because *you can't be what you can't see*.

With many positions of power and influence, worldwide, devoid of women, girls and young women have fewer people, like them, to emulate. We need more women in positions of power and influence – including in the STEM world – for younger generations to emulate.

While more girls are showing an interest in these fields, and more women are pursuing STEM careers than ever before, the gap remains wide between men and women. You see it across the globe.

This is a critical problem, considering that an estimated 80% of all jobs in the future will require some sort of STEM training or expertise<sup>1</sup>. And yet women, who comprise 59% of the workforce, only fill 30% of jobs at major technology companies. Even more troubling, 40% of women with engineering degrees never enter the field or quickly move out of it<sup>2</sup>.

Again, we ask ourselves "Why?"

What are the factors that may be steering girls and young women elsewhere, and denying them rewarding careers in science, technology, engineering and math? Losing out on these women is especially critical as the world faces a severe shortage of STEM-ready workers to fill millions of job openings in the coming years.

I hope you agree with me that the barriers to women in STEM can be overcome if we – as parents, teachers, counselors, STEM workers and others of influence – are there to educate and encourage females at key moments in their lives. Mastercard is working to make a difference through programs such as Girls4Tech™, our signature STEM education platform, which strives to narrow the gender gap by cultivating young technology enthusiasts through mentorship and opportunity.

Let's stop just discussing the problem and better understand how to get more women interested in STEM long-term. They – and our ever-changing world – will be better for it.



**DANA LORBERG**  
Executive Vice President, Operations & Technology, Mastercard



**SECTION I:**

# The Equality Battleground: Understanding How We Got Here.

For too long, our world was designed and has been operated without the input of or consideration for women. Consider this:

**100** Years Ago:

The 19<sup>th</sup> Amendment earned women the **right to vote in the United States** (about 150 years after men), though individual states continued to disenfranchise women via financial, educational, and racial barriers<sup>3</sup>.

**48** Years Ago:

Congress passed Title IX, stating that **no one, on the basis of sex, could be denied access** to federally funded educational programs<sup>4</sup>.

**46** Years Ago:

Congress passed the Equal Credit Opportunity Act of 1974, which **prohibited credit discrimination** against someone based on their gender, sex, race, religion and national origin, among others<sup>5</sup>. Finally, women could obtain a credit card without spousal or parental approval.

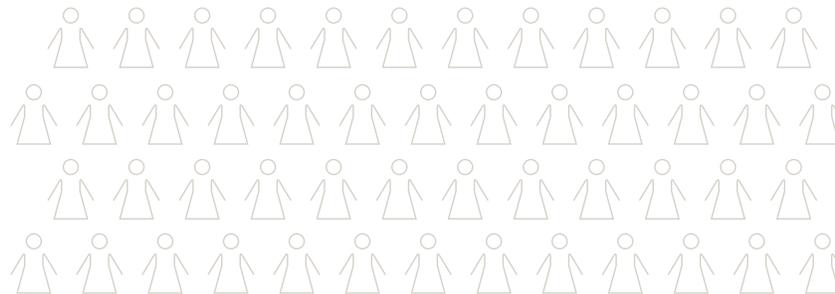
While progress has been steady, delineation between opportunities for men and women still exist in far too many circumstances, maintaining this vast and quite tangible divide illustrating the depth of inequality in the United States (as well as the world).

For instance, women still earn 82 cents on the dollar compared to men<sup>6</sup> (a figure further skewed by racial inequality), sparsely occupy positions in corporate C-suites, and are less likely to earn venture capital funding when starting a new business.

And for STEM occupations, these gender discrepancies are particularly apparent. The media consistently talks about the STEM gender gap and male domination in Silicon Valley and other high-tech hubs, and yet those problems go unaddressed year after year. It's plain as day – the gender gap remains unnecessarily wide.

That raises two compelling questions:

*Why the disparity? And what can we do about it?*





## KEY FINDINGS

Mastercard, a leading global payments and technology company, has long sought to inspire young people – particularly women and underrepresented minorities – to consider careers in STEM. To learn more about the causes and possible remedies for this disparity, Mastercard, in 2019, commissioned a study seeking to understand gender and generational differences surrounding perceptions and attitudes of science, technology, engineering and mathematics (STEM). In addition to STEM-based topics, the survey investigated challenges and motivations to pursuing college majors and career paths.

The results revealed some shocking insights, among them:



**We're only focusing on 1/2 of the equation.**

We spend too much time focusing on deterrents, and not enough time understanding motivators. But when paired together, we begin to get a clear picture of how we can more successfully impact the STEM gender divide.



**Old values die hard.**

The narrative around STEM has remained consistent despite the clear gender gap. Historically, women have been told they are better served in “soft skilled” careers and it’s clear this continues to have a lasting impact on their preferred studies and potential career preferences – and even more daunting, their confidence levels in STEM subjects.



**Showcase female STEM leaders.**

We focus so much attention on this being a boys’ club and not enough attention on the successes of the women in the field. We need to show younger generations women “just like them” and share those accomplishments. In other words, let’s bring forward and celebrate these trailblazers for the next generation.

In the sections that follow, we delve deeper into these findings further to better understand what motivates and deters young women from pursuing STEM careers.





**SECTION II:**

# Mind the Gap: Understanding Roadblocks to STEM.

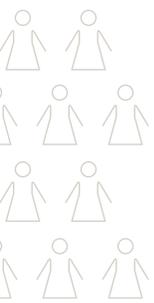
The STEM gender gap conversation isn't new. For years, social scientists and other have examined the gender gap in STEM – from the bigger picture to its minute details. And while hypotheses about its causes are many, solutions have been few.

That said, many of the conversations in the media and in academia focusing on the “whys” of the problem are reinforced by the survey results and provide additional insight into why there are fewer women than men in STEM.

**LACK OF EXPOSURE**

What is STEM and what are the range of careers and jobs included in its four categories? Too few girls – and even boys – know.

**Girls need to be exposed to the potential career opportunities in STEM at a young age to better identify with their own interests.**



Girls need to be exposed to the potential career opportunities in STEM at a young age to better identify with their own interests. Going into STEM doesn't just mean becoming a scientist in a lab; girls need exposure to the vast possibilities of a career in STEM.

While women are notoriously encouraged to pursue more creative or gender-traditional pursuits, the STEM gender gap isn't closing because women of all ages are less likely to understand what the STEM field truly has to offer – and, importantly, less likely to be encouraged to explore STEM.

And those perceptions and influences start early in life.

As the survey revealed, males develop positivity toward STEM subjects at an early age. For example, Gen Z males are more likely to say their favorite subject is math compared to Gen Z females (28% versus 15%).

And even more so, females overall were more likely to say they do not like math, science or computer science because it is too hard (52% versus 41%)

or they are just bad at it. (See Figure 01)

But glimmers of hope are apparent. Gen Z (21%) and millennial (20%) females are almost equally as likely as Gen Z (23%) and millennial males (20%) to say science is their favorite subject. The issue remains, however – how to keep that interest long-term and translate it into careers.





**LACK OF CONFIDENCE**

If girls are receiving less exposure to or encouragement to pursue STEM-related topics at an early age, it seems understandable that they would be less confident in their abilities with related school subjects and in their self-perceptions of intelligence. And that is evident in the survey findings.

Women consistently view themselves as less intelligent than their peers and less confident in STEM-specific subjects (although the gap is narrower among Gen Z females). For instance, 82% of millennial males consider themselves smarter than their peers compared to 73% of millennial females. However, the gap is somewhat narrower among Gen Z females, with 67% considering themselves to be smarter than their peers versus 72% of Gen Z males.

Furthermore, Gen Z males expressed that they thought they were better than their classmates in technology (82% versus 65% for females), engineering (71% versus 46% for females), math (68% versus 59% for females), and science (79% versus 77% for females).

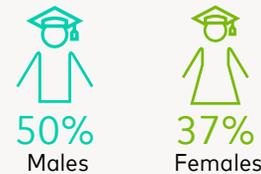
versus 46% for females) and math (68% versus 59% for females). The gap was narrower, however, in science – 79% for Gen Z males versus 77% for Gen Z females. (See Figure 02)

Across the board, males expressed more confidence in learning almost all subjects. The gap widens when looking at STEM-specific topics like math (35% of males are confident versus 25% of females) and computer science (26% males versus 21% females), while females are more likely to feel confident studying English (36% males versus 46% females).

Obviously, this lack of STEM confidence may be a huge deterrent in getting females to engage in STEM and pursue related majors. In fact, 50% of high-school aged males say they plan on majoring in STEM, compared to only 37% of female high-schoolers. (See Figure 03) And the same is true at the college level with 46% of college males planning on/or currently majoring in STEM, compared to only 38% of college females.

FIGURE 03

High-school aged males are more motivated to major in STEM:

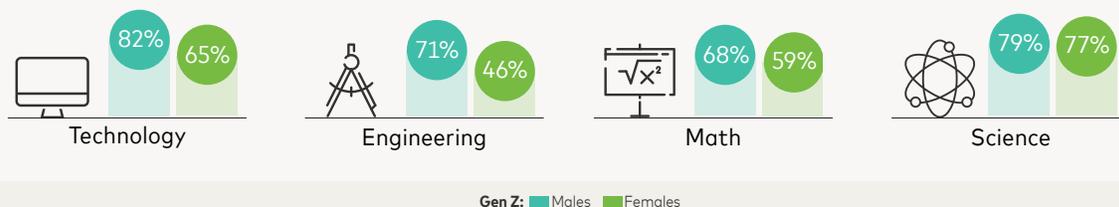


Interestingly, in Gen Z, there is not as significant a difference among middle schoolers with respect to their confidence in being STEM-successful, but high school males (89% versus 80% females) and college males (88% versus 78% females) are more likely to say they would be successful, showing that confidence is beginning to weaken in Gen Z females as they age.

Yet, past research studies have found that women are equally – and in more cases, more – proficient than men in studying STEM subjects. They simply have more confidence in other subjects where they also excel, based on a recent OECD study<sup>7</sup>.

FIGURE 02

Gen Z males expressed that they thought they were better than their classmates in:





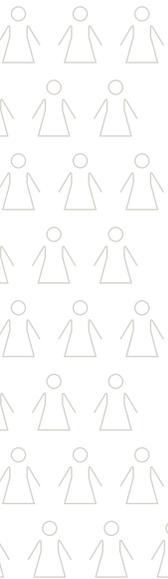
**LACK OF ENCOURAGEMENT**

Numerous research studies and surveys have shown that parents and caregivers often treat sons and daughters differently when it comes to technology and sciences – potentially creating the aforementioned lack of confidence felt by girls with respect to being interested in studying and pursuing careers in STEM.

Both Gen Z males (83% versus 77% females) and millennial males (77% versus 67% females) report receiving more encouragement from teachers to pursue STEM-related subjects and careers. (See *Figure 04*) Fortunately, however, this gap may be narrowing even further, as there seems to be a generational shift in STEM encouragement focused on females. Gen Z females (77%) are more likely to be

encouraged to do well in STEM compared to millennial females (67%).

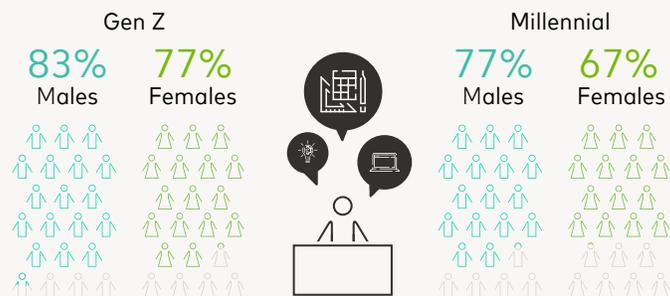
Nevertheless, this sense of feeling less supported – combined with females’ self-perception and lack of confidence surrounding STEM – highlights a clear need for greater encouragement and mentorship beginning at an early age and continuing well into adulthood.



...this sense of feeling less supported... highlights a clear need for greater encouragement and mentorship beginning at an early age and continuing well into adulthood.

FIGURE 04

Males report receiving more encouragement from teachers to pursue STEM-related subjects and careers:





**SECTION III:**

# Recognizing and Embracing Motivators.

Having examined what deters young women from pursuing STEM, it's equally important to understand what motivates women academically and how these factors may impact their interest in STEM specifically.

And there are some apparent red flags.

For instance, females are more likely to be motivated to do well in school by getting good grades (66% females versus 52% males), enjoying learning (46% females versus 39% males) or getting a cool job (29% females versus 38% males).

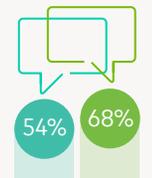
The gap is especially apparent for the younger generation, with 68% of Gen Z females saying they are motivated by wanting to get good grades

If females feel less confident about STEM-related subjects and their primary motivation is to get good grades and enjoy learning, then women will be less inclined to pursue STEM-related studies or jobs.

versus 54% of Gen Z males. Further, 40% of Gen Z females are motivated by enjoying learning versus 30% of Gen Z males. On the other hand, Gen Z males are more likely to cite money as motivating factor (51% of Gen Z males versus 41% of Gen Z females). (See Figure 05)

FIGURE 05

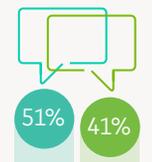
Gen Z students are more likely to be motivated by:



Wanting to get good grades



Learning



Money

Gen Z: ■ Males ■ Females

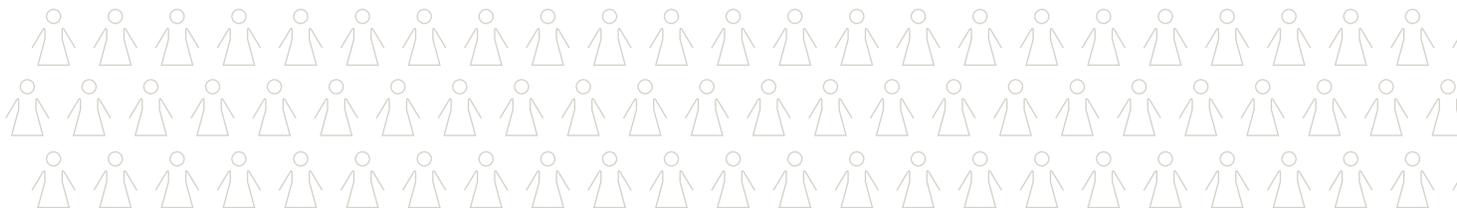
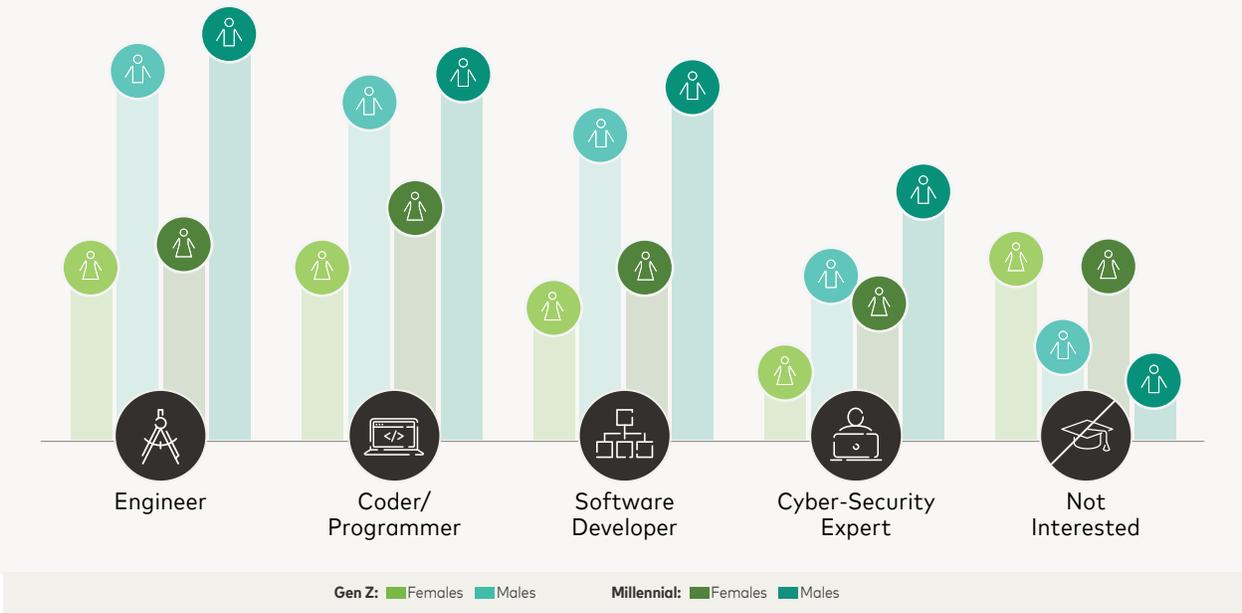




FIGURE 06

Gen Z and Millennial men say they are more interested in pursuing most STEM-specific careers.

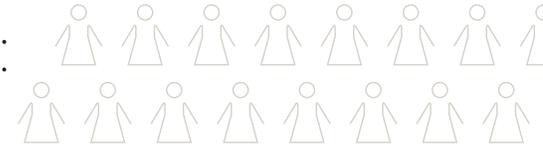


These motivational differences, coupled with confidence levels, no doubt factor into female versus male job preferences. If females feel less confident about STEM-related subjects and their primary motivation is to get good grades and enjoy learning, then women will be less inclined to pursue STEM-related studies or jobs. The survey revealed that 47% of males said they would be interested in being an engineer versus just 22% of females. In computer science, too, the disparity is drastic with 42% of males saying they would be interested in a job as a coder/programmer compared to just 25% of females; and 40% of males saying the same for software developer jobs, compared to just 19% of females. (See Figure 06)



## SECTION IV:

# Narrowing the STEM Gap: How to Make an Impact.



Now that we're armed with a better understanding of the STEM landscape for women, it's time to take action. How do we, as a society, ensure we don't just keep talking about these gender issues and actually take action to make an impact?

Based on survey findings, and other empirical data, we believe there are three key areas that will help narrow – and, ultimately, eliminate – the STEM gap.

### **STEP ONE: ENCOURAGE EARLY, OFTEN...AND WHEN IT MATTERS MOST**

As noted previously, archaic views of gender roles and societal expectations die hard, even in this era, which heavily emphasizes equality for all people, regardless of demographic or group.

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**From an early age, parents and guardians can play a critical role in guiding daughters and changing the STEM status quo.**

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From an early age, parents and guardians can play a critical role in guiding daughters and changing the STEM status quo. Recent studies have found that parents are clearly an untapped resource for encouraging children to pursue STEM studies, and forwarding off the prevailing message that STEM is only for boys<sup>8</sup>.

The results can be quite startling: According to a University of Washington study of high school students, children of parents who informed them about the value of math and science from an early age are more likely to take higher-level math and science classes than children of parents who do not provide that information.

But the work isn't just done in the early years. Parents, guardians and teachers must provide consistent touchpoints in middle school, high school and college – and especially during the major decision times in their daughters' lives, such as choosing high school courses, the college admissions process and selecting a college major.

While intervention at younger ages is a must, we also need to make sure we continue to support women well into high school when girls' overall confidence levels begin to diminish significantly. They may question their level of intelligence or their abilities to succeed in STEM-related courses. Thus, at this age, girls need additional support and encouragement to boost their confidence.

When parents, guardians, teachers and other mentors show up during and throughout these critical decision points, young women will be less likely to be dissuaded from pursuing a challenging yet ultimately rewarding STEM career path.

To support parents, guardians and teachers in these endeavors, STEM-related corporations should invest in programs that can bolster these endeavors. With real commitment, these organizations can make a material impact in seeding future STEM-enthusiasts.



**STEP TWO:  
MENTORS, MENTORS  
AND MORE MENTORS**

It's true. You can't be what you can't see. So more female STEM workers, especially those from underrepresented groups, must work with young women to show them all the pathways to STEM success.

Of those who report having a mentor, females are more likely to say their mentor encourages and recognizes when they do well (69% versus 60% of males). And encouragement is important since males (71%) are significantly more likely to say they've been encouraged to pursue a career in STEM, compared to females (57%).

The need is critical. A mentor or role model can help young women "see" themselves in STEM careers by introducing them to someone "just like them" in the field. It is hard to imagine yourself pursuing a career when there isn't a single visible person who looks like you in that career. Representation matters.

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*It isn't just about ones and zeroes, it can be like learning a new language.*

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*It is hard to imagine yourself pursuing a career when there isn't a single visible person who looks like you in that career.*

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**STEP THREE:  
SHOW-AND-TELL**

An ancillary to increasing the role of mentors is to better showcase the breadth and depth of STEM jobs – and the women who are performing them. It's time to amp up the volume and not just talk about STEM, but to show it in action.

Coding, for example, isn't just about ones and zeroes, it can be like learning a new language. Programming, AR/VR can be used to create avant-garde art or create an app that brings a taxi to your door. And STEM careers – even beyond medicine or environmental studies – can have a positive impact on the world around.

When we shift what we think we know about STEM and how we introduce it to the next generation, we can foster greater excitement for pursuing a STEM career – and that's true regardless of gender.

*"We see first-hand the benefit of mentorship in Mastercard's signature STEM education program, Girls4Tech™. When girls see Mastercard mentors, women in careers pertaining to fraud detection and cryptology, they suddenly see a new path and have more confidence that they could become that, too."*

–Susan Warner, VP Community Engagement & Founder Girls4Tech, Mastercard

Beyond highlighting differentiated STEM careers, we also need to better celebrate the standout work of women in STEM – be it school projects or STEM leaders. There are so many stories of successful technologists and scientists – both in our history and present day – that go untold. The more we bring these stories to the centerfold, the more women in STEM will feel – and be – less of a rarity.



# Methodology

Mastercard commissioned a U.S.-based study to better understand how perceptions and attitudes of science, technology, engineering and mathematics (STEM) differ across generations and gender. In addition to STEM-based topics, the survey investigated challenges and motivations for pursuing STEM college majors and career paths. An online survey of 3,803 respondents based in the United States, with an oversample of boys and girls from age 7 to 17 (n=100 for boys and n=100 for girls in each age group 7-9, 10-12, 13-15, 16-17) and n=3,000 census-representative of age, gender, ethnicity, race and income for males and females 18+, was conducted from September 6<sup>th</sup> to September 16<sup>th</sup>, 2019. The total sample was nationally representative of region and ethnicity with a 2% margin of error.



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