



Portray Her 2.0

An Analysis of 15 Years of Women in
STEM On-Screen, 2007–2022



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MESSAGE FROM Geena Davis

Five years ago, the Institute collaborated with IF/THEN® (an initiative of Lyda Hill Philanthropies) to analyze the portrayals of women in STEM on screen over 10 years, from 2007–2017. We initiated this research because entertainment media shapes our self-perception and how we view others. This includes influencing our attitudes towards STEM and our beliefs about who can pursue STEM interests. In the U.S., women are still significantly underrepresented in STEM fields, a situation partly attributed to prevailing perceptions about women’s place in STEM.

That’s why I was thrilled to once again partner with IF/THEN® to further our efforts to improve and diversify STEM roles on screen. With their support, we have conducted a longitudinal analysis of STEM characters on screen (from 2018–2022), and have surveyed a nationally representative sample of girls and young women (in middle, high school, and college), to understand the landscape, and to make precisely-targeted recommendations for creators that will shift the terrain.

As an advocate for equality on screen, I know that representation in entertainment media shapes societal norms and individual perceptions. Historically, the landscape of film and television has mirrored a skewed reality, one where diverse voices and stories are conspicuously underrepresented. This imbalance does more than distort our view of the world; it limits our imaginations. When young children turn on their screens, the characters they see – or don’t see – send a powerful message about who matters and who doesn’t, and about what is considered possible and what is not. As members of the entertainment industry, we have the opportunity to move past our longstanding default ideas about who should fill a STEM character role — and motivate more girls and women to emerge as future STEM leaders and pioneers.



Shayan Asgharnia / AUGUST



Halfpoint Images/Moment via Getty Images

Executive Summary

Has the on-screen representation of women in STEM changed since 2018, when the Institute released its report “Portray Her: Representations of Women STEM Characters in Media”? To answer that question, our new report—“Portray Her 2.0: An Analysis of 15 Years of Women in STEM On-Screen, 2007–2022”—refreshes the analysis of STEM characters on-screen by looking at the past five years of TV and film. In this latest version, we provide novel recommendations for improving diverse STEM representation based on new insights for those who can influence the next 15 years of entertainment media.

The influence of entertainment media on attitudes and beliefs related to science is often overlooked, even though 81% of Americans are exposed to science-related content by it (e.g., films or shows about medical settings or criminal investigations, or set in sci-fi worlds).¹ The subject of this study is if and how entertainment media perpetuates STEM representation inequalities. In the U.S., women remain sorely underrepresented in STEM professions, and even when their representation improves, other inequalities emerge, including those related to job retention, pay, and status. Our previous report, which looked at the representation of women in STEM in film and TV from 2007–2017, found that women in STEM were underrepresented relative to men about 2 to 1, and that most female STEM characters worked in the life sciences (primarily in the medical field), thereby portraying limited possibilities for audiences. In this new study, we again look at the representation of women in STEM in film and TV from the past five years (2018–2022). We also include a survey of girls and young women (those in middle-school, high-school, and undergraduate age groups), to better understand their STEM experiences and the role of fictional STEM characters on their interests and ambitions. For a review of all findings, please read the full report. We present key findings here:

- ◆ **On-screen, men in STEM still outnumber women in STEM.** From 2007–2017, 37% of STEM characters were women. From 2018–2022, 38% of STEM characters were women. There has been little change in women’s representation of STEM characters for all levels of prominence.
- ◆ **There has been a big increase in STEM characters of color.** From 2007–2017, 29% of STEM characters were people of color. From 2018–2022, that number increased to 42%. This change, however, was concentrated in medical professions and not seen across STEM fields.
- ◆ **In newer films and TV shows, women are shown in more diverse STEM fields.** From 2007–2017, nearly 66% of female characters in STEM were in the life sciences (primarily the medical field). From 2018–2022, about 56% of female characters in STEM were shown in the life sciences. There was a marked increase in female characters shown as engineers (from 2% to 13%), and computer scientists or programmers (from 7% to 15%).
- ◆ **In newer films and TV shows, more women in STEM are given the role of the villain.** In films and TV shows from 2007–2017, men in STEM were eight times more likely than women to be villains (8% of all male STEM characters, compared with 1% of all female STEM characters). In films and TV shows from 2018–2022, men in STEM are still about two times as likely as women to be villains (11% of all male STEM characters, compared with 6% of all female STEM characters). Overall, this represents a sharp increase for women. This is important because villains are prominent roles and allow for more diverse STEM portrayals.
- ◆ **Male STEM characters were more likely than female STEM characters to be professionally motivated by selfish reasons.** In film and TV from 2018–2022, male STEM characters were more likely than women to be motivated by glory, pride, or financial gain (22% compared with 13%), which reinforces a gendered depiction of STEM pursuits as well as potentially harmful norms surrounding masculinity.
- ◆ **Well-known STEM tropes, like the “mad scientist” or “unkempt” computer programmer, were rare.** But 11% of STEM characters were “uncool” and 12% were shown to have “innate” talent, both of which are depictions that are likely to discourage girls and young women from STEM pursuits. These tropes were not measured in the previous study.
- ◆ **More girls and young women want to see female STEM characters on-screen.** In 2023, 71% of survey respondents agree that it is important to have female representation of STEM characters on-screen, a 20-percentage-point increase from 2018. Additionally, most girls and young women say that they enjoy watching movies or television shows about STEM-related topics (62%) and wish there were more female STEM characters in movies and on TV (72%).
- ◆ **Girls and young women think most STEM characters on TV are men.** Characters who play civil engineers, software developers, and mathematicians are overwhelmingly recollected to be portrayed by men, suggesting that viewers are taking note of women’s underrepresentation on-screen.
- ◆ **STEM characters played by women of color have a positive impact on young women of color who are watching.** Among respondents of color, 72% said that Shuri and 68% said that Riri Williams (characters in Black Panther: Wakanda Forever) had a positive influence on their interest in STEM, compared with 52% of white respondents who said the same for both characters. This finding points to the importance of audiences seeing a character they identify with, especially with respect to race/ethnicity.



Introduction

Five years ago, the Geena Davis Institute collaborated with IF/THEN® (an initiative of Lyda Hill Philanthropies) to study how women in the science, technology, engineering, and math fields, known as STEM, are represented in popular entertainment media from 2007–2017. The resulting report — “Portray Her: Representations of Women STEM Characters in Media” — revealed a troubling lack of diversity.² Male characters outnumbered female characters by about 2 to 1, and the overwhelming majority of characters were white (about 71%). On balance, female characters in STEM careers were portrayed in a positive but limited fashion. These women were rarely featured in leading roles. They were also disproportionately represented in careers in life sciences, such as doctors, but conspicuously absent from engineering, computer science, and the physical sciences (such as chemistry and geology) — a pattern mirroring disparities in real-world representation. On the flip side, women in STEM were generally depicted as intelligent and competent, and sometimes as leaders in their STEM field. However, their success generally came at a cost — a career in STEM was commonly portrayed as sacrificing family and personal relationships, which studies say is a source of women’s underrepresentation in these fields. In this respect, popular entertainment media paints a picture of women in STEM and working in STEM fields for young female audiences that may contribute to women’s underrepresentation.

To better understand the connection between representations of women in STEM and young women’s attitudes toward STEM careers, our previous study supplemented the content analysis with a survey of three cohorts of young women: girls in middle school, girls in high school, and full-time college students that identified as women ages 18 to 24 years old. Across all of the young women surveyed, about 51% indicated that seeing female characters with STEM interests and STEM careers was very important or

important to them. These characters served as role models for many young women, who cited specific characters (e.g., April Sexton of *Chicago Med*, Meredith Grey of *Grey's Anatomy*, Alexx Woods of *CSI: Miami*, and Mindy Lahiri of *The Mindy Project*) as responsible for sparking their own STEM ambitions.

The survey also revealed some limiting beliefs that young women held about STEM careers. First, a majority of the young women surveyed perceived STEM careers as incompatible with family and caregiving responsibilities — a figure that mirrors the findings from our content analysis about the portrayal of STEM professions. A second finding that points to obstacles for young women's STEM ambitions is their beliefs about sexism in STEM fields. Collectively, one-third of those surveyed agreed that women face sexism in STEM fields. These beliefs were even stronger among full-time college students, 51% of whom expressed concern about sexism in STEM. This result suggests that young viewers may connect the dearth of women in STEM careers in media as evidence of a chilly climate for women in STEM in reality.

All told, our previous study confirmed that stereotypes about STEM professions are both connected to media representations of these careers, and influential for young women's career ambitions.³

In the present study, we follow up on our analysis that looked at STEM characters in television and film from 2007–2017, to assess the next generation of female STEM characters in media. This study explores whether female STEM characters today are more common and/or more racially diverse. This study also explores whether outdated stereotypes about STEM fields are reinforced or disrupted in television and film from 2018–2022. We again reached out to young women to ask what they're watching and how it tracks with their own career interests and trajectories to get a sense of what's changed and what hasn't.

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It wasn't that girls weren't interested in science. We just weren't seeing them on screen.

JJ JOHNSON, WRITER/CREATOR, *JANE*, *ANNEDROIDS*,
DINO DANA, SINKING SHIP ENTERTAINMENT



Background

The State of Women in STEM Careers

Increasing women's representation in STEM would be socially, culturally, and economically beneficial, but women remain a minority in these fields in the U.S. According to a U.S. Census Bureau report published in 2021, just 35% of those working in STEM were women as of 2019.⁴ While this is a marked increase from 1970, when just 8% of those working in STEM were women, women's entry into STEM has been slow relative to other fields.⁵

According to reports by the National Science Foundation, STEM occupations are expected to outpace non-STEM occupations in the U.S. in the coming years, and these occupations generally outrank non-STEM occupations in terms of pay.⁶ Ensuring that women can enter and thrive in these fields can contribute to economic equality, in addition to bringing broader perspectives and solutions to some of the biggest challenges we face now and will face in the future.

While a higher share of women are working in STEM today than in the 1970s, they still experience bias in hiring, promotion, and compensation. For example, a study of doctoral recipients from 1972–1997 in science fields found that female STEM faculty were paid less than male faculty.⁷ And a study from 2021 found that female physicians earn an average \$2 million less than their male counterparts over the

course of their careers, which was the largest gender pay gap of any STEM field.⁸ And when it comes to leadership positions within STEM fields, men are still more likely to advance.⁹ Scholars attribute the gender gaps in leadership positions to institutional barriers (e.g., lack of paid leave), in-field biases that privilege male-coded work over female-coded work,¹⁰ and unconscious bias (e.g., publication rates for women increase under double-blind conditions at academic journals, suggesting when reviewers know the authors' gender, men's papers are reviewed more favorably).¹¹

In addition to gender-based barriers, women of color, queer women, and disabled women face even greater challenges not experienced by their white, straight, or able-bodied colleagues.¹² For example, a 2019 study found that women of color were the least likely to be offered speaking opportunities at scientific conferences.¹³ In another study, two-thirds of women scientists from ethnic minority groups in the U.S. reported that they felt pressure to continually prove themselves beyond what was asked of white colleagues.¹⁴ These studies shine a light on how intersecting identities shape women's experiences in STEM.

Despite all of these hurdles, STEM is growing more diverse regarding gender, but that shift is being driven by particular fields, such as math and physical sciences (e.g., chemistry, or climate studies). According to a 2019 report from the U.S. Census Bureau, women in these fields' occupations are 47% and 45% of the workforce, respectively. But in computer science, women are just 25% of the workforce, and women make up only 15% of the engineering workforce. Crucially, computer science and engineering make up 80% of the STEM workforce, overall.¹⁵

Similar patterns emerge at U.S. colleges and universities. Although women now make up the majority of college graduates in the U.S., and the share of STEM majors overall has grown, women still lag behind men in engineering and computer science. According to a Pew Research Center report analyzing data from the 2017–2018 school year at the bachelor's level, women were the majority of majors in health-related (85%) and life-science (61%) fields, compared with 42% of math, 40% of physical science, and just 22% of engineering and 19% of computer science.¹⁶ At the graduate level, men earn 72% of master's and 75% of doctoral degrees in engineering, and in math and computer science, men earn 65% of master's and 74% of doctoral degrees, according to data collected for the 2019–2020 academic year.¹⁷

And while women's representation in medical fields is improving (they are nearly 80% of the health care workforce), they are underrepresented as executives, board members, and doctors, which are high paying and high prestige roles.¹⁸

These numbers tell us that women are represented in some fields but remain a small share in others, or in lower paying roles. Below, we explain some of this uneven progress.

Why Are There Fewer Women than Men in STEM?

There is a long history of exclusion of women and girls from STEM fields, either through banning women outright or gender-based restrictions that functioned to keep women out of these spaces.¹⁹ In the U.S, the 1972 federal civil rights law commonly known as Title IX removed many of the formal barriers women faced, and since the enactment of Title IX, the number of women entering STEM fields has been growing.²⁰ But the removal of formal barriers is only part of the solution. Prejudice against girls and women, implicit bias, stereotypes, and institutional biases continue to fuel the persistent gender gap in STEM fields in the U.S. As of 2021, women still make up only 35% of the STEM workforce,²¹ despite major educational gains since the enactment of Title IX, and they still face explicit sexism.²² However, girls, women, and their allies are responding and mobilizing.²³ Being aware of barriers that women face is how we can remove them.

GENDER STEREOTYPES DIFFER ACROSS STEM FIELDS

To understand the persistent gender gaps in STEM, it is important to look at differences in the stereotypes associated with different STEM fields.²⁴ As reviewed, engineering and computer science especially have wider gender gaps, and these fields also carry more unwavering male-coded stereotypes than other fields do.^{25,26} These fields also have the strongest perceived masculinity attribution according to male and female survey respondents.²⁷ Compare that with health and environmental sciences, where more women are employed and which are perceived as less stereotypically masculine.²⁸

The “role congruity theory” helps explain this outcome. The theory contends that the more overlap there is between the traits associated with an individual’s gender role and the traits associated with an occupational role, the greater the perceived competence of that person in that role.²⁹ Because girls in the U.S. are raised with more of a communal orientation than boys³⁰ — which means they are more likely to prioritize working with others and helping others — and because physics, engineering, and computer science are not strongly associated with communal activities, girls are less inclined to enter them and,

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When creating content for kids, who are still forming their views of the world, we have an obligation to make sure young girls know that they belong in STEM too. This is so cheesy to say, but we should write the world we want to see, not the world as it is.

GABRIELLE MEYER, STORY EDITOR, ADA TWIST, SCIENTIST

if they do, are perceived as less competent. Research shows that STEM professions broadly are less attractive to women because stereotypes of scientists show this work as highly individualized and mostly performed for personal benefit, which are goals that women are less likely to be motivated by.³¹ Therefore, the stronger that association is with a field, the less appetizing it will seem to individuals who are more communal, and women tend to be more communal than men.

In short, because women are more likely than men to be community-oriented and to be driven by goals of collaborative work, altruism, and helping others, they are more likely than men to avoid STEM professions that are not associated with these goals.^{32,33}

Given this, we see a growth of women in STEM fields like health sciences, which are more likely to be ascribed community-oriented behaviors.

But the notion that work in non-health-science fields is inhospitable to collaboration or not in service to others is misleading and does not reflect the communal nature of much scientific work. STEM work is often collaborative and aimed at helping others. Additionally, although studies find that women value communal goals more than men do, people of all genders value communal goals, which suggests more people would pursue STEM careers if those careers were more accurately portrayed and understood. Indeed, people who perceive STEM as achieving communal goals have more positive attitudes toward STEM, and students in middle school, high school, and college who perceive science as helping others are more inclined to pursue a career in the sciences.³⁴

In sum, these studies suggest that fields that are more masculine-coded draw in more men, while fields that are more feminine-coded draw in more women. Of course, STEM careers of all types require a mix of skill sets, and these assumptions present a false choice about what types of doors certain majors can open.

PATHWAYS AND DISCRIMINATION

During childhood, in school, and in their careers, girls and women face discrimination that may cause them to abandon their STEM goals, interests, and pursuits.³⁵ For example, as young children, boys and girls engage in STEM-related activities at a similar rate;^{36,37} however, gender differences occur in the types of encouragement children receive from parents, teachers, and mentors.^{38,39} One study found that adults are more likely to encourage boys to engage with tools (e.g., a microscope), while girls are more likely to be encouraged to engage with domestic-related activities, like sewing or gardening.⁴⁰ A more recent study found parents perceive their sons to have higher mental manipulation and navigation abilities, which led them to encourage sons more than daughters to pursue STEM.⁴¹ Furthermore, adults provide boys with opportunities to learn about STEM, regardless of how interested they are in STEM-related topics, while girls are often provided opportunities in STEM activities only when they explicitly express an interest in them.⁴² As such, many more boys are provided encouragement and opportunities related to STEM than girls, likely as a result of internalized gender stereotypes that parents, teachers, and other adults have about the topic.

By the time children are in high school, boys consistently demonstrate more interest than girls in STEM.⁴³ Experiences in the classroom exacerbate this gap. For example, a study found that in classrooms where most students believed that boys were naturally better than girls at math correlated with poorer math test scores among female students when compared with classrooms where most students did not believe boys were naturally better at math than girls. Girls were also less likely to participate in math-related extracurricular activities and reported lower math-related confidence who were in classrooms where their peers had a strong belief in this stereotype.⁴⁴ Interestingly, some studies find that girls attending all-girls schools are more likely than girls attending co-ed schools to express interest in STEM subjects and take advanced-level physics courses.^{45,46,47} Despite differences in encouragement and opportunities in early life, there are few performance differences between women and men.⁴⁸ In high school and college, women and girls outperform their male counterparts in math courses.⁴⁹ Nevertheless, women are significantly less likely than men to choose STEM majors when they enter college.^{50,51} Within graduate education, STEM-granting programs with better resources and higher levels of student funding have significantly lower inclusion of women students than other Ph.D. programs.⁵² Furthermore, research shows gender differences in how performances are internally rationalized — with men tending to attribute their success in STEM due to innate talent, while women perceive their success in STEM due to hard work or luck.⁵³

Finally, anticipation of sexism in the workplace further depresses interest in STEM careers for young women and girls.⁵⁴ The anticipation that women will face gender discrimination in a particular field is one reason that college-bound women avoid specific majors.⁵⁵ In fact, perception of gender bias in professions is the “dominant predictor” of gender imbalance in college majors for both STEM and non-STEM majors.⁵⁶ Engineering, physical science, and computer science had the highest levels of perceived gender bias among female respondents, while health, clinical sciences, and psychology had lower levels of perceived gender bias among STEM majors.

However, several industries, including STEM fields,⁵⁷ have attempted to address issues related to sexual harassment and discrimination, in response to the #MeToo movement, which shone a light on gender discrimination and sexual harassment. Surveys around the height of the movement indicated that issues of workplace discrimination rose in terms of importance, especially among working-aged women.⁵⁸ While the #MeToo movement has shifted public opinion on sexual harassment and assault⁵⁹ and led to meaningful policy changes,⁶⁰ several recent studies have revealed that efforts to eradicate gender discrimination and harassment are adversely impacting women at the workplace because of how men are adjusting their behaviors. According to a 2022 study from Pew Research Center, 55% of male respondents said the #MeToo movement made it harder for men to know how to interact with women in the workplace.⁶¹ In 2019, a study by LinkedIn found that 60% of male managers were uncomfortable doing common workplace activities with women, such as mentoring, socializing, or having one-on-one meetings.⁶² In a profession that can require long hours in the lab in close proximity and mixed-gender relationships, women are being adversely impacted by male managers and coworkers taking the wrong lessons from the #MeToo movement, particularly early on in their careers. In this manner, media about

STEM should depict men and women working together to solve problems, and avoid dramatizations that paint women as using a system to punish their male colleagues. Solutions to reduce or remove significant barriers of entry for women are unlikely to take a one-size-fits-all form, given that women of color face different hurdles than white women,⁶³ and the role of entertainment media should be embraced as one of many tools we have to bridge the gender gap.

Fostering More Gender Inclusion in STEM through Entertainment Media

To combat associations that lead to fewer women and girls in STEM, there are several solutions, including elevating diverse role models, both real and imagined, who share diverse STEM experiences and skills. STEM role models can inspire and empower young women to pursue careers in STEM. According to social cognitive theory,⁶⁴ central to the motivation to pursue a career is self-efficacy (i.e., expectation of success in the career),⁶⁵ and “a key source of self-efficacy is observing a relatable role model succeed on similar task.”⁶⁶ Young people develop career interests by observing and identifying with role models, including fictional ones they encounter in the media.⁶⁷ Young viewers form a “wishful identification” with these characters and develop a sense of a future possible self capable of fulfilling a similar role.⁶⁸

The absence of diverse STEM role models in entertainment media can exacerbate demographic gaps in real-world STEM professions by shortcutting this “wishful identification” process. For example, GDI’s 2018 study “The ‘Scully Effect’” looked at how exposure to *The X-Files*’ protagonist Dana Scully motivated girls and women to enter the STEM field.⁶⁹ Nearly two-thirds of the respondents currently working in STEM said that Scully served as their personal role model and increased their confidence to excel in the male-dominated profession.⁷⁰ In short, the way scientists are portrayed on-screen has real consequences for young people’s career ambitions.

While certain criteria are critical to ensure role models contribute to diversifying STEM fields,⁷¹ studies consistently identify exposure to women and people of color in STEM as an important motivator for girls and children of color.^{72,73,74} Moreover, exposure to role models from underrepresented groups (e.g., women as well as men and women of color) does not decrease motivation for boys or white children.⁷⁵ But negative stereotypes about STEM role models (such as “the loner” or “nerd”) decrease interest in STEM among youth of all genders.⁷⁶ This is why it is important for young people to have STEM role models who break the stereotypical mold of what is commonly thought to be a STEM professional.

Media representations play a part in discouraging girls and women from entering into STEM fields by reinforcing stereotypes that define science as a stereotypical pursuit for men.⁷⁷ Stereotypes that align science with men have existed for the better part of a century and continue to surface in media depictions today. These portrayals often reinforce the stereotype of the lone, nerdy scientist in a lab

coat, mostly portrayed as an awkward white man⁷⁸ or a “mad scientist.”⁷⁹ The “mad scientist” originated from the “mad alchemist” in the 14th century, but the trope has evolved in the present day to be an expert in chemistry, physics, neuroscience, and/or technological advancements.^{80,81} The “mad scientist” trope is typically a man who is emotionally unstable, over-determined beyond rational thinking, and presented as a dangerous overreacher, whose determination to transcend human limitations causes a wave of retributive events. Mad scientists obsessively seek knowledge, but they fail to consider the consequences of achieving their goal.⁸² Moreover, this trope often reinforces harmful stereotypes that stigmatize mental health issues. Additionally, “nerd culture” that emerged in the 1980s framed science as a pursuit of charming misfits that largely excluded girls and women.⁸³ Together, the “mad” and “nerd” tropes portray science as a masculine pursuit (but also socially undesirable), and as reviewed above, adolescent girls demonstrate less interest than boys in pursuing occupations they see as masculine.⁸⁴

Popular media may exaggerate gender differences in STEM fields by centralizing male contributions to STEM and rendering female contributions invisible. The practice is so common it has its own term among STEM historians — the “Matilda effect.” Coined by scientific historian Margaret Rossiter, the term refers to “the bias that has led to female researchers being ignored, denied credit or otherwise dropped from sight.”⁸⁵ Examples abound where stories of scientific discovery center on a lone male figure as a genius but overlook the contributions of women to the discovery.⁸⁶ However, many films avoid this trap. *The Imitation Game* from 2014, is a biographical film about mathematician Alan Turing’s decryption efforts during World War II, and it prominently features the contributions and brilliance of mathematician Joan Clarke. Likewise, 2017’s *Hidden Figures* focuses on the essential roles of historically overlooked Black female mathematicians at NASA during the Space Race. *The Imitation Game* was the top-grossing independent film of 2014,⁸⁷ and *Hidden Figures* was a commercial and critical success (garnering three Oscar nominations) demonstrating how featuring the contributions of women in STEM not only creates a richer and more accurate historical depiction of major STEM achievements but also can be lucrative at the box office.

Movies and television are so expansive because they expose us to worlds we may not see in our own lives. And if a young girl is never exposed to a world in which women are active in STEM, how will she know that future is possible for her?

GABRIELLE MEYER, STORY EDITOR, *ADA TWIST*, *SCIENTIST*

Limited representations of STEM characters (not only gender, but also racial and ethnic minorities, disabled characters, and LGBTQIA+ characters)⁸⁸ can have pernicious real-world consequences. According to cultivation theory — a framework stemming from sociological studies of communication — consumers internalize the explicit and implicit messages conveyed in media and, over the long term, develop a sense of the world that aligns with how it's characterized in entertainment media.⁸⁹ Through repeated exposure, entertainment media reinforces stereotypes and molds worldviews — including stereotypes and beliefs about STEM fields — and these beliefs tend to be persistent once formed. If STEM characters are disproportionately white, heterosexual, and male, entertainment media produces and reinforces stereotypic expectations that STEM fields are a good fit culturally for other white, heterosexual men. The absence of characters from marginalized identities can contribute to perceptions that these fields aren't welcoming to people who don't match that stereotype profile.⁹⁰

The good news is that these limiting stereotypes can be disrupted through improved representation of STEM characters in entertainment media. Across a number of studies, it's clear that young girls are particularly motivated by female STEM characters.⁹¹ For example, some fans have noted that the *X-Files* character Dana Scully inspired a host of other stereotype-disrupting women STEM characters in television and film.⁹² We found a similar result in our past “Portray Her” report.⁹³ The young women we surveyed overwhelmingly indicated that seeing female characters with STEM interests and in STEM careers had a significant personal impact. Many cited female STEM characters as role models who inspired a decision to pursue STEM coursework or STEM careers.

Creating opportunities for better STEM representation in popular media will facilitate meaningful change in the real world. As activists and leading scientific organizations have pointed out, recruiting a scientific community that mirrors our society will lead to new insights and help more of the potential scientists among us develop their talents. Many obstacles contribute to the lingering inequalities in science, but popular images of the profession can dismantle these barriers.⁹⁴

At the end of this report, we outline specific recommendations based on our findings, to aid media professionals and creators interested in supporting an evolution in STEM representation on-screen.



Methodology

Survey Analysis

This study presents findings from a survey of girls and young women about their STEM experiences and interests. This survey was administered from June 8 to June 23, 2023, by Wunderman Thompson. We surveyed 917 respondents ages 11 to 24 who live in the U.S., and the findings here concern students in middle school, high school, and college, up to the age of 24.⁹⁵ We compare responses (when available) to survey data collected in 2018⁹⁶. In 2018, we also surveyed 915 young women and girls ages 11 to 24 who live in the U.S.

Content Analysis

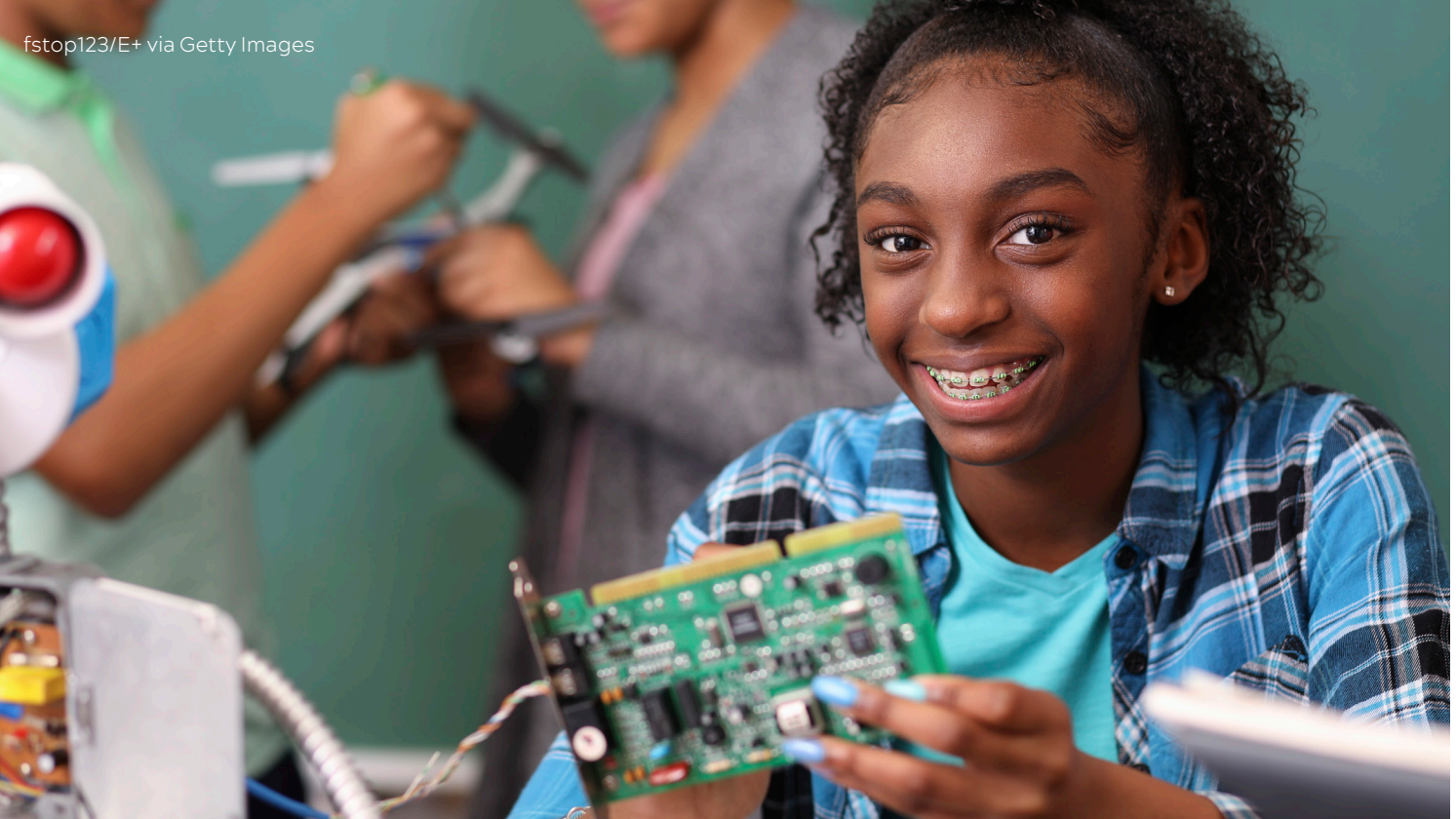
To assess how STEM is portrayed in entertainment media, we analyze all STEM characters who appeared in the title casts of films and popular television series released from 2018–2022. Using the trade database Luminate by Variety, we identified all films (both theatrical and streaming) with a budget of \$20 million or more that were released from 2018–2022, which was a total of 471 films. We then identified films with a STEM character in the title cast, resulting in 198 films. For television, we sampled from the most popular programming each year from 2018–2022, identified by Nielsen (broadcast and cable) and Rotten Tomatoes (streaming). From these lists, we identified shows with a series regular who is a STEM character, and selected two episodes from each show, totaling 1,624 characters from 515 series.⁹⁷ All variables are tested for reliability among our human expert coders, who undergo a rigorous training process. All variables included in the report have met standards of interrater reliability.

In addition to TV and film, we also assess STEM representation in educational and informational (E/I) programming in the U.S. Due to federal regulations, broadcast television networks are required to air at least three hours per week of programming that “serves the educational and informational needs of children as a significant purpose.”⁹⁸ This programming, commonly referred to as “E/I,” must serve children 16 years old or younger and must air between the hours of 6 a.m. and 10 p.m.⁹⁹ Given the educational and informational nature of these E/I blocks, many of these programs feature STEM topics. Thus, we present an additional analysis of on-camera talent featured in these shows, including STEM experts. We analyzed 54 episodes of shows that aired in network E/I blocks between June 17 and July 8, 2023. In total, there were 212 STEM experts or hosts featured in these programs.

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They may not be hearing it as frequently from their parents or from the news or from their teachers...[that] they can be scientists...[media is] the greatest way to reach young people, because young girls aren't always going to listen to what their parents say or what their teachers say is cool...they're going to listen to us!

MIKA ABDALLA, *PROJECT MC2* (PORTRAYHER SYMPOSIUM)



Findings

Survey Analysis

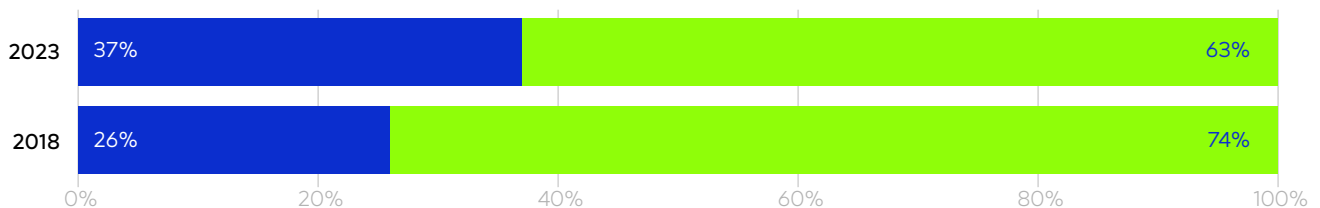
Analysis of survey responses suggests that, compared with the findings from the 2018 version of this survey, today’s girls and young women are more likely to say they think they’ll have a successful career in STEM. For instance, in 2018, 26% of all respondents said they believed they would have a successful STEM career, but in 2023, that number jumped 11 percentage points, to 37%. The number of respondents saying they would likely graduate with a STEM-related major increased more than 10 percentage points since 2018, from 27% to 38%.

CHART 1

Share of respondents who believe they will make a STEM contribution professionally, in 2018 and 2023

“I will have a successful professional career and make substantial STEM contributions....”

● Very strongly, or strongly agree ● Somewhat, or do not agree

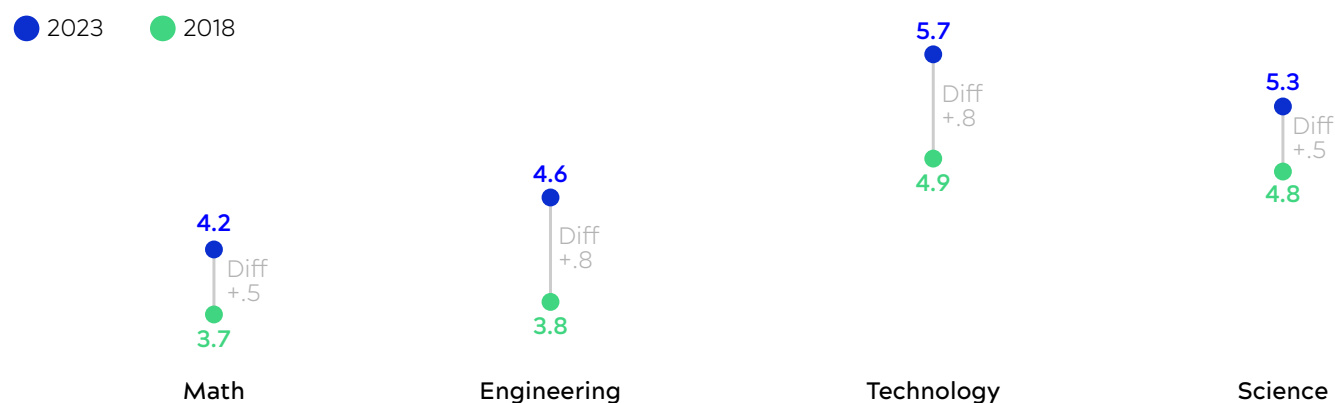


Question wording: “How much do you agree or disagree with the following statements?” Response options: four-point scale (very strong agree, strongly agree, somewhat agree, do not agree). We’ve grouped the top two options and bottom two options together.

Respondents were also asked to rate descriptions of STEM fields using the STEM Semantics Scale. Respondents received adjective pairs (fascinating vs. mundane, appealing vs. unappealing, exciting vs. unexciting, means a lot vs. means nothing, and interesting vs. boring) and selected a number on a seven-point Likert scale indicating which adjective best represented each field. Chart 2 presents the average combined ratings for STEM fields, comparing 2018 with 2023. Higher scores correspond to more favorable evaluations. For all STEM fields, perceptions of STEM among girls and young women has improved (see Chart 2). As in 2018, the “technology” field is viewed as the most positive and “math” as the least positive in 2023.

CHART 2

Perceptions of STEM fields on a scale from 1 to 7, in 2018 and 2023



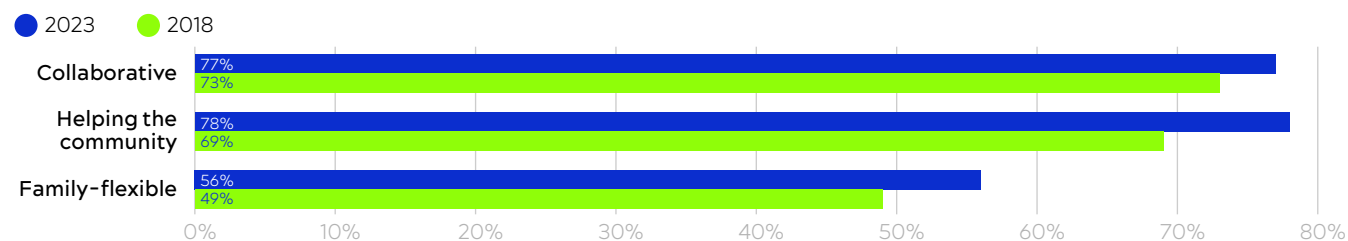
Question wording: “Which phrase best completes the sentence ‘To me, this subject is ...?’” Response options: fascinating/mundane, appealing/unappealing, exciting/unexciting, means a lot/means nothing, interesting/boring. High scores indicate more positive evaluations. Scores are summed across all questions, then averaged to scale between 1 (low) and 7 (high).

PERCEPTIONS OF STEM FIELDS

General perceptions of STEM careers are positive overall. Compared with respondents in 2018, girls and young women today perceive STEM as more congruent with goals and priorities that are more likely to align with their preferences, including a collaborative work environment, helping the community, and affording the flexibility needed to balance career and family (Chart 3).

CHART 3

Perceptions of a career in STEM, in 2018 and 2023



Question wording: “How often do you think that people in STEM careers [work alone, help the community, have time to spend with family].” Response options: four-point scale (very often, often [agree]; sometimes, never [disagree]).

Overall, 3 in 4 respondents feel that STEM careers are collaborative (77%), and 78% of respondents feel that people in STEM careers help the community. Additionally, 56% feel that a career in STEM would afford time to spend with their families. These responses represent a marked increase since 2018 in perceptions that STEM work is collaborative, other-oriented, and family-flexible. This is a promising finding, given that internalization of these more favorable attributes of STEM careers may encourage more female students to enter STEM fields.

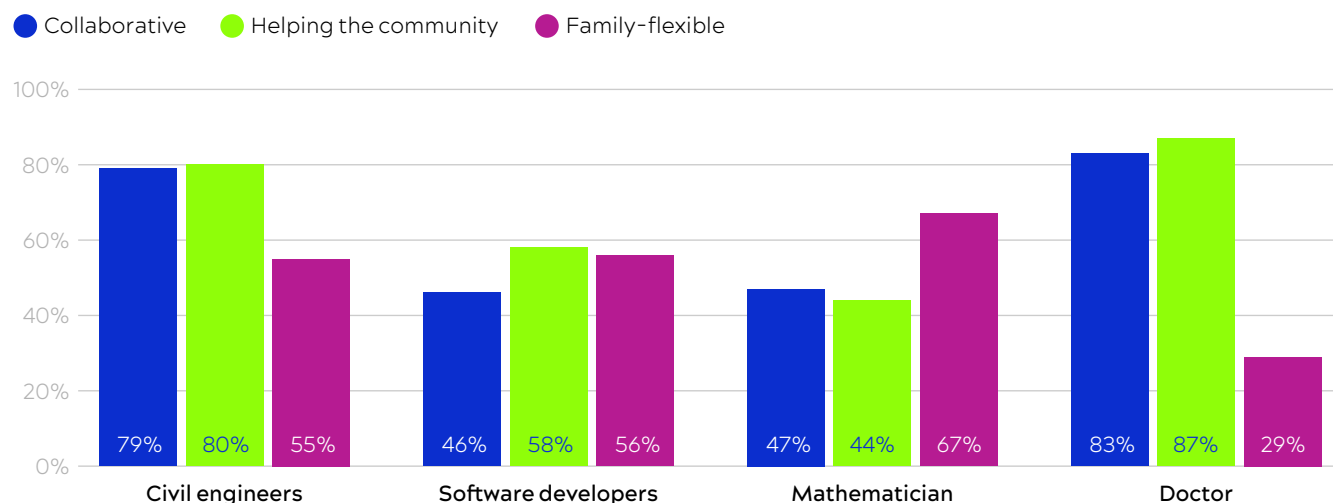
However, some STEM fields and careers are seen as less collaborative, other-oriented, and family-flexible. In addition to inquiring about STEM broadly, we asked respondents to evaluate the following careers: software developer, civil engineer, mathematician, and doctor. More than half of respondents say that they perceive software developers and mathematicians as mostly working alone, compared with only 21% of respondents who perceive civil engineers as working alone and just 17% perceive doctors as working alone.

Regarding which career is seen as helping the community, strong majorities agree that a career as a doctor (87%) and a civil engineer (80%) meet this criteria. But when it comes to a career as a software developer or a mathematician, only 58% and 44%, respectively, agree that those are community-oriented.

Of the four STEM careers we focused on in our survey, a career as a doctor is seen as least family-flexible (29%). More than half of respondents perceive a career as a mathematician (67%), software developer (56%), and civil engineer (55%) as family-friendly.

CHART 4

Perceptions of STEM and STEM careers, in 2023

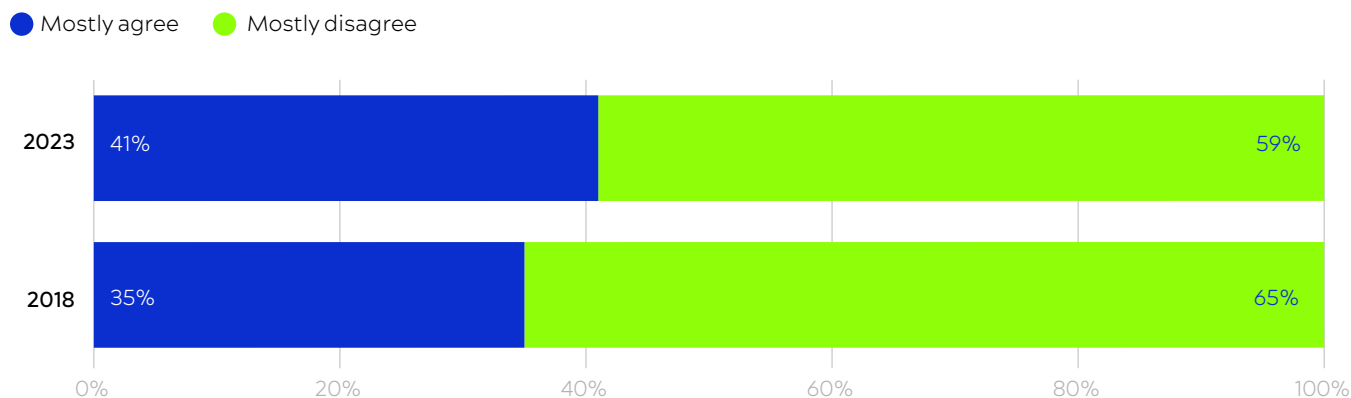


Question wording: “How often do you think that [career] [work alone, help the community, have time to spend with family].”
Response options: four-point scale (very often, often [agree]; sometimes, never [disagree]).

Although girls and young women surveyed in 2023 see STEM careers as more congruent with interests that favor girls and women, they are also more likely than respondents in 2018 to perceive that women in STEM experience sexism (41% in 2023, compared with 35% in 2018). This increase in the salience of sexism in the workplace may be due to more exposure of these problems, resulting from the #MeToo movement.

CHART 5

Perceptions of sexism in STEM, in 2018 and 2023



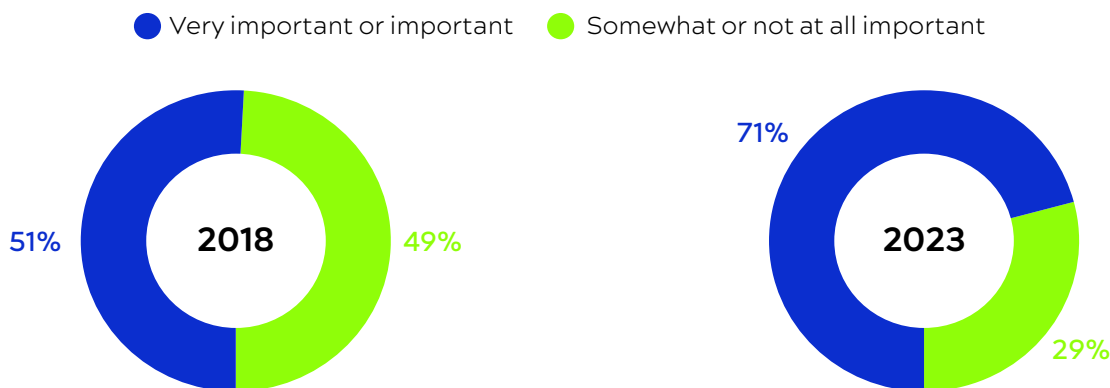
Question wording: “How much do you agree that women in STEM experience sexism?” Response options: four-point scale (very strongly agree, strongly agree [mostly agree]; somewhat agree, do not agree [mostly disagree]).

PERCEPTIONS OF STEM CHARACTERS ON-SCREEN

We also asked girls and young women to evaluate the portrayals of women in STEM that they see in entertainment media. In 2023, 71% of respondents agree that it is important to have female representation of STEM characters on-screen, a 20-percentage-point increase from 2018, when 51% of respondents said it was important or very important to see women in STEM on-screen. This big increase suggests that the role of media as an agent of socialization is more influential today.

CHART 6

How important is it to see women and girls in STEM on-screen?



Question wording: “How important is it to you to see girls and women as STEM characters in television shows?” Response options: four-point scale (very important, important, somewhat important, not at all important). We’ve grouped the top two response options and bottom two response options together.

According to the survey, most girls and young women say that they enjoy watching movies or television shows about STEM-related topics (62%), and wish there were more movies and television shows about STEM (56%). They also overwhelmingly wish there were more female STEM characters in movies and on TV (72%). (See Table 1.) The desire to have media reflect the increasing numbers of women in STEM careers corresponds with the high interest in STEM careers and subjects, and suggests that girls and young women notice a gender imbalance in portrayals of STEM professions on-screen.

TABLE 1

Girls and young women want to see female STEM characters on-screen

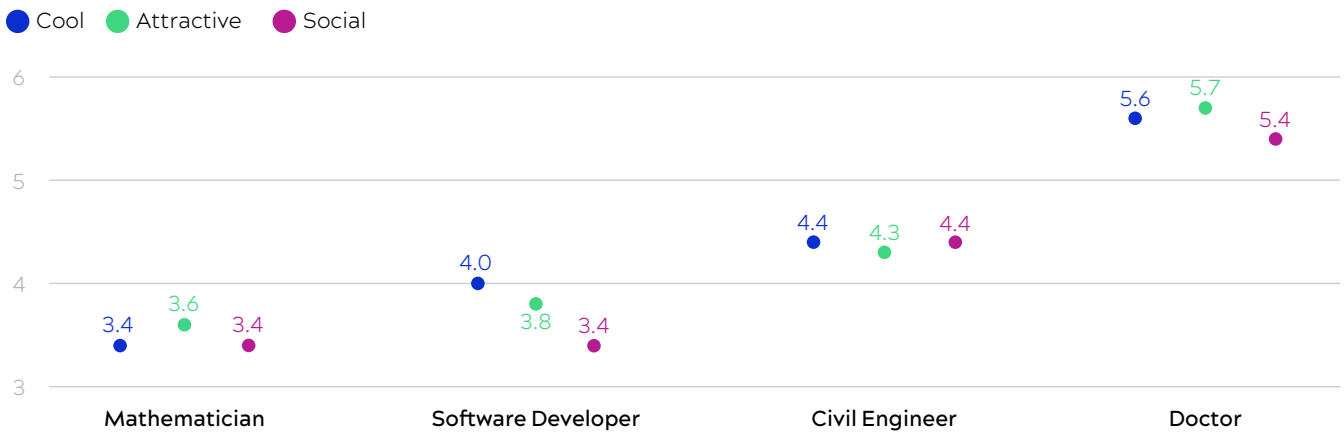
	I enjoy watching movies or television shows that are about STEM-related topics	I wish there were more movies and television shows about STEM	I wish there were more female STEM characters
Agree	62%	56%	72%
Neither agree nor disagree	25%	29%	22%
Disagree	13%	15%	6%

Question wording: “How much do you agree or disagree with the following statements?” Response options: five-point scale (strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree).

As reviewed above, past research suggests stereotypes about STEM careers contribute to lower interest, less encouragement, and failed retention of girls and young women in STEM. To better understand perceptions of STEM careers on-screen, we asked respondents to indicate the degree to which characters portraying mathematicians, software developers, civil engineers, and doctors were cool, attractive, and social.

CHART 7

Are STEM characters cool, attractive, or social? Average response on a seven-point scale

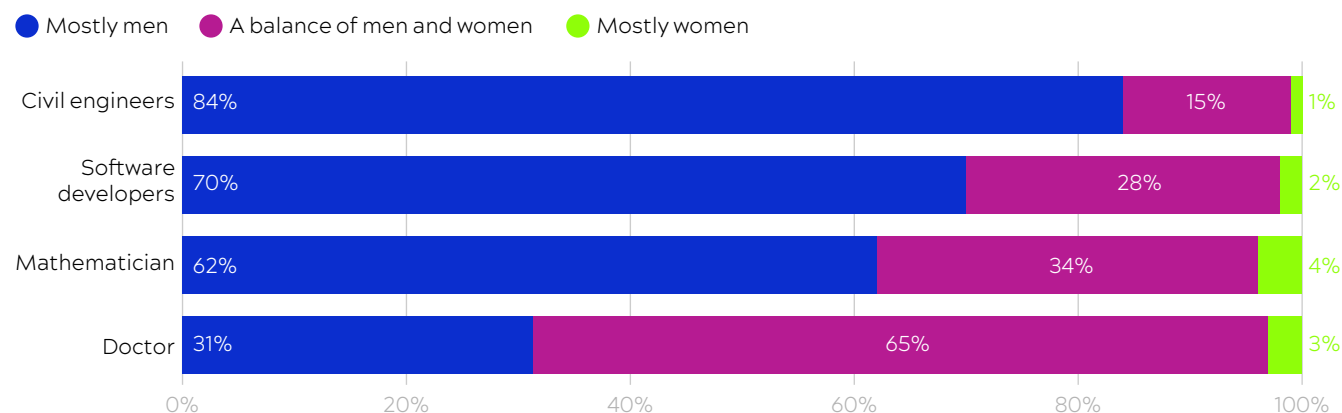


Question wording: “What do you think of characters on TV shows or in movies who portray a [career]? How are they typically portrayed as [cool, attractive, social].” High scores indicate more positive evaluations. Scores range from 1 (low) and 7 (high).

As shown in Chart 7, girls and young women most negatively perceive media portrayals of mathematicians. This is consistent with studies on dominant media portrayals of math as “difficult, cold, abstract, theoretical, ultrarational, but important and largely masculine.”¹⁰⁰ Girls and young women report positive perceptions of doctors, who on average were seen as the most cool, attractive, and social of all the careers surveyed.

CHART 8

Portrayal of STEM profession gender balance on TV or in movies, in 2023



Question wording: “When you think of characters on TV shows or in movies who portray the following STEM professions [civil engineers, software developers, mathematicians, doctors], are they portrayed by mostly men, mostly women, or a balance of both?” Response options: mostly men, mostly women, a balance of men and women.

We also asked respondents to recollect the gender of characters in STEM they have seen on-screen. As shown in Chart 8, there are no STEM careers that girls and young women think of as portrayed by mostly women in TV and film. Doctors are perceived to have the most gender-balanced portrayal, with 65% of respondents stating that doctors are portrayed by a balance of men and women. High shares of respondents recollect civil engineers (84%), software developers (70%), and mathematicians (62%) to be portrayed by mostly men in TV and film. Perceived portrayals exceed actual gender imbalances in these careers’ corresponding fields when compared with data from the U.S. Bureau of Labor and Statistics, suggesting that there is a perception that media sources exaggerate gender differences in already gender-imbalanced STEM fields. Entertainment media, therefore, may both reinforce and propagate gendered perceptions of STEM fields, particularly in mathematics, computer science, and engineering.

We also ask girls and young women whether they were familiar with a list of female STEM characters on-screen, and if those characters influenced their interest in STEM. The most recognized STEM characters were Doc McStuffins (*Doc McStuffins*), with 58% of respondents familiar with her, followed by Sandy Cheeks (54%) (*SpongeBob SquarePants*), Meredith Grey (46%) (*Grey's Anatomy*), Amy Farrah Fowler (41%) (*The Big Bang Theory*), and Cristina Yang (41%) (*Grey's Anatomy*).

But a character doesn't necessarily need to be universally well-known to be influential. The characters who had the most positive influence on respondents' STEM interests are Penelope Garcia (77%) (*Criminal Minds*), Temperance Brennan (75%) (*Bones*), Abby Scuito (71%) (*NCIS*), Natalie Manning (65%) (*Chicago Med*), Meredith Grey and Cristina Yang (64%) (*Grey's Anatomy*), Shuri (63%) (*Black Panther: Wakanda Forever*), Dana Scully (*The X-Files*), Riri Williams (*Black Panther: Wakanda Forever*), Miranda Bailey (*Grey's Anatomy*) (61%), Dr. Brain (57%) (*Mission Unstoppable*), and April Sexton (56%) (*Chicago Med*). Statistically significant differences emerge if we compare the influence of STEM characters in *Wakanda Forever* on white respondents with those characters' influence on respondents of color. A total of 72% of respondents of color said Shuri and 68% said that Riri Williams had a positive influence on their interest in STEM, compared with the 52% of white respondents who said the same about both characters. This finding points to the importance of seeing a character you identify with, especially with respect to race or ethnicity. Table 2 presents the percentages of girls and women who say each character inspired them to pursue STEM.

[Through representation onscreen, we can show young girls that:] You can be this dynamic, really amazing female, with a love life...and also, be the top of your game and kickin' butt and making a difference...

NKECHI OKORO CARROLL, SHOWRUNNER, EXECUTIVE PRODUCER, *ALL AMERICAN*
(PORTRAYHER SYMPOSIUM)

TABLE 2

Percent of respondents familiar with a character who said they were influential on their STEM interest, in 2023

Character	Percent influential	Character	Percent influential
Penelope Garcia (<i>Criminal Minds</i>)	77%	April Sexton (<i>Chicago Med</i>)	56%
Temperance Brennan (<i>Bones</i>)	75%	Amy Farrah Fowler (<i>The Big Bang Theory</i>)	54%
Abby Sciuto (<i>NCIS</i>)	71%	Dr. Grace Augustine (<i>Avatar</i>)	52%
Natalie Manning (<i>Chicago Med</i>)	65%	Ellie Sattler (<i>Jurassic World Dominion</i>)	51%
Meredith Grey (<i>Grey's Anatomy</i>)	64%	Jane Foster (<i>Thor: Love and Thunder</i>)	51%
Christina Yang (<i>Grey's Anatomy</i>)	64%	Ada Twist (<i>Ada Twist, Scientist</i>)	41%
Shuri (<i>Black Panther: Wakanda Forever</i>)	63%	Doc McStuffins (<i>Doc McStuffins</i>)	38%
Dana Scully (<i>The X-Files</i>)	61%	Luna (<i>Earth to Luna</i>)	38%
Riri Williams (<i>Black Panther: Wakanda Forever</i>)	61%	Harley Quinn (<i>Birds of Prey</i>)	37%
Miranda Bailey (<i>Grey's Anatomy</i>)	61%	Sandy Cheeks (<i>SpongeBob SquarePants</i>)	31%
Dr. Brain - Crystal Dilworth (<i>Mission Unstoppable</i>)	57%	Princess Bubblegum (<i>Adventure Time</i>)	25%

Question wording: Asked of those familiar with character and interested in STEM: “How influential were the following characters on your interest in STEM fields?” Response options: four-point scale (very influential, influential, somewhat influential, not influential). Findings report share who indicated 1 and 2 on the four-point scale.

Respondents found scientists involved in law enforcement and/or forensic science as most influential, such as Penelope Garcia of *Criminal Minds* (77%), Abby Sciuto of *NCIS* (71%), and Temperance Brennan of *Bones* (75%). Doctors followed as the next-most influential characters, such as Meredith Grey (64%), Christina Yang (64%), and Miranda Bailey (61%) — all appearing on *Grey's Anatomy* — as well as Natalie Manning of *Chicago Med* (65%). Among the most influential were also women in STEM in a fictionalized world, like Shuri (63%) and Riri Williams (61%) (*Black Panther: Wakanda Forever*). Finally, despite the show being off-air for decades, *The X-Files*' Dana Scully (61%) is still an influential character for this younger generation.



Content Analysis

Who Is Represented in STEM On-Screen?

Although responses to the survey questions tell us that girls and young women today are more interested in a STEM career than they were in 2017, and that they want to see more of these depictions on-screen, there has been little change from 2007–2017 in women’s representation as STEM characters in major roles (leading, notable supporting, or supporting) in popular television shows and films. (See Chart 9.) The lowest share of female STEM characters was in 2008 (30.7%), while the highest share of female STEM characters was in 2015 (45.1%). From 2007–2017, 37% of STEM characters were women, compared with 38% from 2018–2022. In no year do we observe gender parity in STEM portrayals.

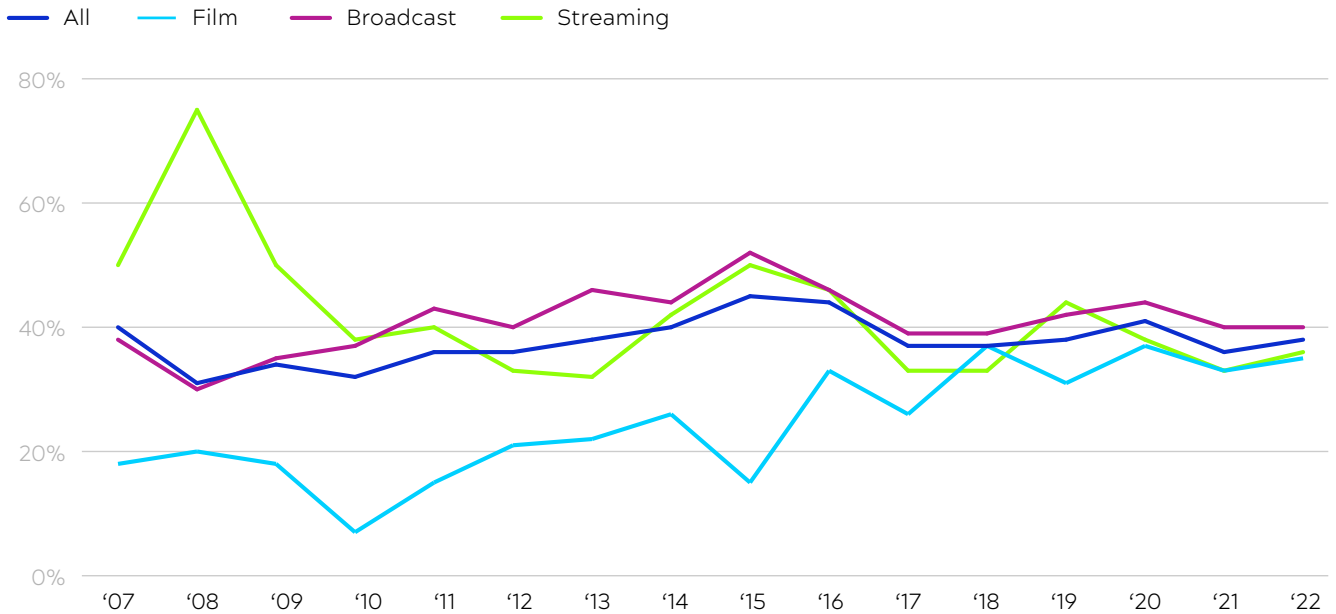
She’s a tech wizard and she looks just like me!

MIKA ABDALLA, *PROJECT MC2* (PORTRAYHER SYMPOSIUM)



CHART 9

Percentage of female STEM characters, 2007–2022

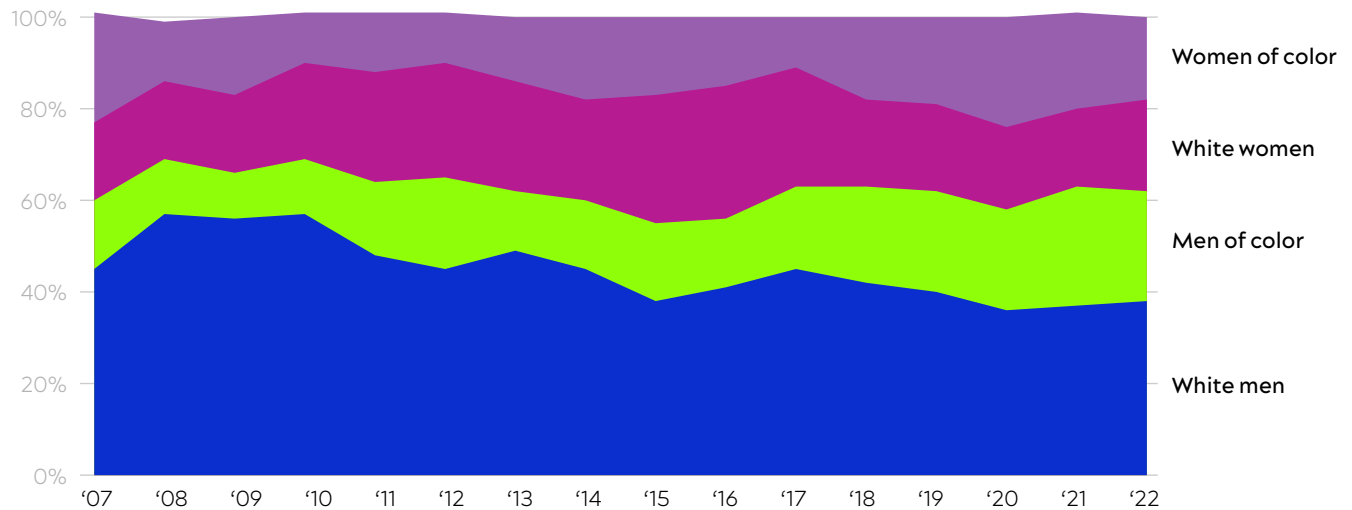


Note: Line represents the share of STEM characters who are girls or women. The remaining STEM characters are boys or men, or nonbinary. Only three STEM characters were identified as nonbinary.

While the gender of STEM characters overall has remained steady, racial diversity has improved. (See Chart 10.) On average, from 2007–2017, 29% of STEM characters were people of color. From 2018–2022, that number improved to 42%. Men of color slightly outnumber women of color.

CHART 10

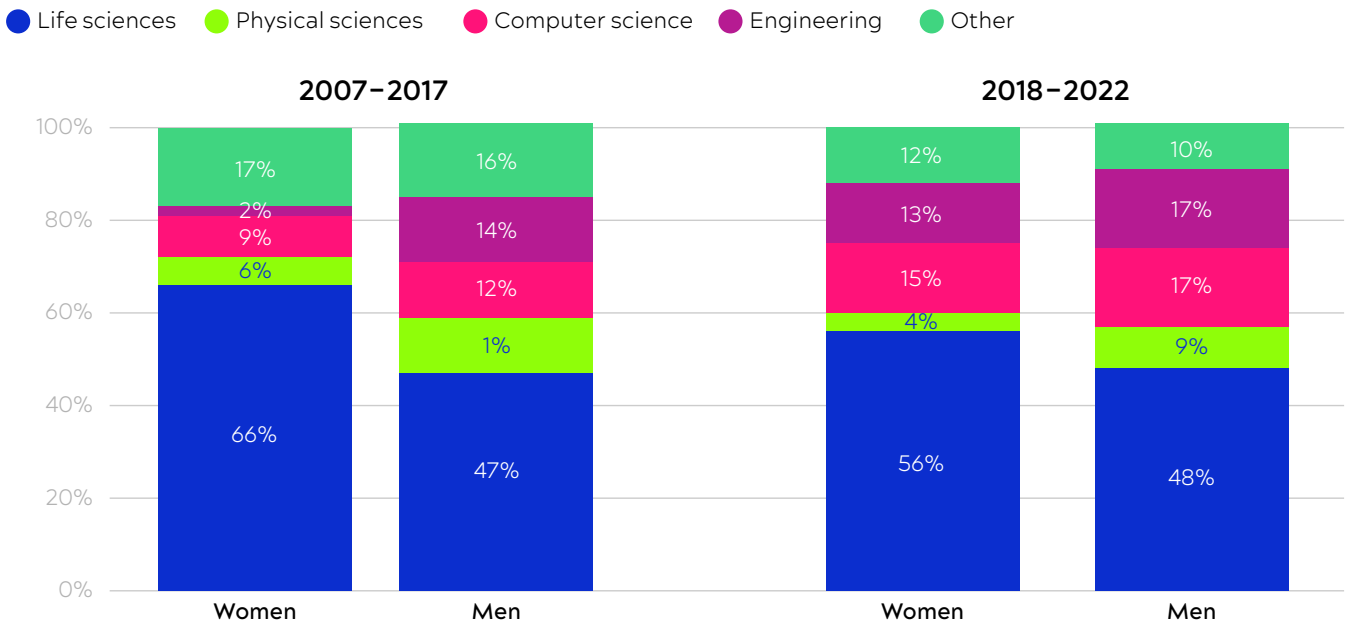
Gender and race of STEM characters by year, 2007–2022



The types of STEM careers women are shown portraying has also diversified. From 2007–2017, nearly 66% of female characters in STEM were in the life sciences (largely shown in the medical field). From 2018–2022, about 56% of female characters in STEM were shown in the life sciences, and there was a marked increase in women in STEM shown as engineers (from 2% to 13%) and as computer scientists (7% to 15%). Overall, the gender gap in portrayals of engineers shrunk the most. So although there are still more male engineers than female engineers on-screen, that gap is less in more recent films and TV shows.

CHART 11

Gender and STEM fields, 2007–2017 compared with 2018–2022



Note: Life sciences include medical and veterinary professions; physical sciences include chemistry, geology, and earth science; computer science includes coding, web and software development; engineering includes electrical, chemical, and mechanical engineering. “Other” STEM professions include intelligence analysts with mixed backgrounds, and archeologists.

“

My hope is that kids watch it and think, ‘Oh wow, I had no idea the world of science was so open to me’ and hopefully inspire kids to study [STEM] in the future.

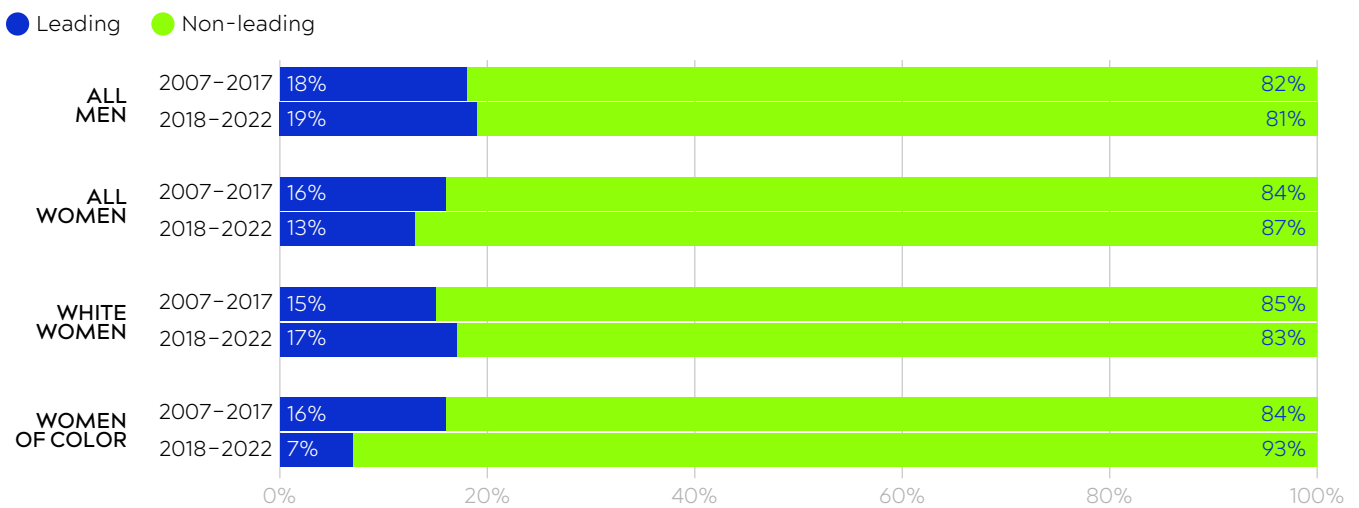
KERRI GRANT, SHOWRUNNER, *ADA TWIST*, *SCIENTIST* (#SEEJANE INFLUENCER SCREENING, 11/16/21)

Which STEM Characters Are in Leading Roles?

Turning to STEM characters in leading or co-leading roles, there has been little change in the share who are in STEM careers or fields. In more recent film and TV shows, 13% of women in STEM are in leading roles, compared with 16% in 2007–2017. The drop may be due to more female STEM characters played by women of color, who are not being cast in leading roles. In film and TV from 2007–2017, 16% of women of color in STEM were in leading or co-leading roles; in film and TV from 2018–2022, just 7% of women of color in STEM were in leading or co-leading roles.

CHART 12

Gender and race for leading/co-leading STEM characters, 2007–2017 compared with 2018–2022



Note: Findings indicate the share of STEM characters within each identity group who were identified as in leading roles from the story’s narrative. Many STEM characters in the films and shows analyzed were not in leading roles, but instead in notable supporting or supporting roles. There were no leading nonbinary STEM characters.

The gender of protagonists matters because it sends a subtle message about whose stories are worth telling. Other archetypes also hold particular importance, such as heroes and villains. The hero archetype provides inspiration and serves as a role model because heroes triumph over evil or another obstacle. Villain archetypes are also important because this archetype tends to be complex and crucial to the plotline, thus given narrative prominence.

In films and TV shows from 2007–2017, women in STEM were slightly more likely than men in STEM to be heroes, but that difference was not statistically significant (22% compared with 19%). In films and TV shows from 2018–2022, the gap is wider (27% of STEM women are heroes, compared with 23% of STEM men), and the difference is statistically significant. There is not a statistically significant difference when we look at the race of women in STEM: White women and women of color in STEM are heroes at a similar rate (25% compared with 28%). From 2007–2017, white women were more likely than women of color to be portrayed as heroes (23% compared with 14%). Remaining STEM characters were not identified as heroes.

In films and TV shows from 2007–2017, men in STEM were eight times more likely than women to be villains (8% compared with 1%), and in films and TV shows from 2018–2022, men in STEM are about two times as likely as women to be villains (11% compared with 6%). Additionally, in recent films and TV shows, white women in STEM are five times more likely than women of color to be villains (10% compared with 2%). This was true from 2007–2017 as well, when 3% of white women and 1% of women of color in STEM were villains. Remaining STEM characters were not identified as villains.

TABLE 3

STEM heroes by gender, 2007–2017 compared with 2018–2022

Year	2007–2017	2018–2022
Female STEM characters	22%	27%*
Male STEM characters	19%	23%*

Note: Cell indicates the share of male and female characters who were heroes in the narrative storyline. The remaining share of STEM characters were not heroes in the storyline. Asterisk (*) indicates a statistically significant difference in male and female portrayals.

TABLE 4

STEM villains by gender, 2007–2017 compared with 2018–2022

Year	2007–2017	2018–2022
Female STEM characters	1%*	6%*
Male STEM characters	8%*	11%*

Note: Cell indicates the share of male and female characters who were villains in the narrative storyline. The remaining share of STEM characters were not villains in the storyline. Asterisk (*) indicates a statistically significant difference in male and female portrayals.

...we really wanted to show that scientists look like everyone and that science happens everywhere

KERRI GRANT, SHOWRUNNER, *ADA TWIST*, *SCIENTIST* (#SEEJANE INFLUENCER SCREENING, 11/16/21)

“

Are Gender-Based STEM Tropes Common On-Screen?

Another source for the gender gap in STEM is the perception that STEM is not family-flexible, not collaborative, and that it isn't oriented towards helping others. These are clearly over-generalizations (if not outright myths) about STEM work, yet do films and TV perpetuate them?

As we found in films and TV shows from 2007–2017, male and female STEM characters from 2018–2022 were rarely shown sacrificing their personal life for work (just 9% of male and female STEM characters) or working alone (20% compared with 16%). However, male characters were significantly more likely than female characters to be shown as carrying out their STEM work for selfish reasons (e.g., glory, pride, financial gain) (22% compared with 13%), which reinforces a gendered depiction of STEM pursuits.

Other STEM stereotypes we explored were tropes like the “mad scientist,” the ideas that STEM is “uncool,” that people in STEM are “unkempt,” and that STEM skills come naturally, or are innate. These stereotypes or tropes are harmful because they can paint STEM studies and careers as undesirable (if STEM is seen as uncool or STEM professionals as unkempt), or as unwelcoming to people for whom STEM skills are challenging to learn (if STEM professionals are seen as innately talented).

Our findings suggest that overall, in film and TV shows from 2018–2022, just 3% of characters embodied the “mad scientist” trope, and there is not a significant gender gap (2% of female STEM characters, compared with 4% of male STEM characters). (See Table 5.)

TABLE 5

Stereotypes about STEM professionals by gender and year, 2018–2022

STEM trope	All STEM characters	Female STEM characters	Male STEM characters
Mad scientist	3%	2%	4%
Uncool	11%	5%*	14%*
Unkempt	2%	2%	3%
Innate talent	12%	14%	11%

Note: Asterisk (*) indicates a statistically significant difference in gender portrayals of the trope.

But 11% of STEM characters are written as “uncool,” and there is a gender gap here: 14% of male STEM characters embodied the uncool stereotype, compared with just 5% of female STEM characters. Very few STEM characters embodied the “unkempt” stereotype (2%), and there was no gender gap for this. But 12% of STEM characters were portrayed in a way that their STEM skills were innate, though there was no significant gender gap. Although it is good to see the absence of a gender gap in portrayals that STEM skills are innate, such portrayals can still have negative consequences on STEM pursuits among young girls and women.

STEM Representation in Educational Programming

In addition to analysis of STEM representation in film and scripted TV, we also looked at STEM representation in TV shows that meet educational programming standards in the U.S. As reviewed in the methodology, we analyzed 54 episodes of shows that aired in network educational/informational (E/I) programming blocks between June 17 and July 8, 2023. Included in these programming blocks is the series *Mission Unstoppable*, which is part of the CBS Saturday morning lineup. *Mission Unstoppable* is supported by Lyda Hill Philanthropies and is a collaboration with GDI and Hearst Media Production Group. The goal of the show is to feature women in STEM doing new, fun and innovative science on-screen. In total, there were 212 STEM experts or hosts featured in all E/I programs. In Table 6, we show that 58% of STEM experts were men; if we exclude *Mission Unstoppable*, that increases to 64%. Similarly, more than half of hosts of these shows are men (53%); if we exclude *Mission Unstoppable*, that increases to 61%. (See Table 7.) As such, *Mission Unstoppable* is helping to bridge the gender gap in STEM representation in E/I programming.

TABLE 6

Gender of STEM experts in educational content, on air in 2023

	All shows	Excluding <i>Mission Unstoppable</i>
Male experts	58%	64%
Female experts	42%	36%

Note: Findings presented are from an analysis of 54 episodes of shows that aired in network E/I blocks between June 17 and July 8, 2023. In total, there were 212 STEM experts or hosts featured in these programs. The networks included CBS, ABC, NBC, Fox, and The CW.

TABLE 7

Gender of hosts of educational programming, on air in 2023

	All shows	Excluding Mission Unstoppable
Male hosts	53%	61%
Female hosts	47%	39%

Note: Note: Findings presented are from an analysis of 54 episodes of shows that aired in network E/I blocks between June 17 and July 8, 2023. In total, there were 212 STEM experts or hosts featured in these programs. The networks included CBS, ABC, NBC, Fox, and The CW.

Like scripted TV, E/I programming mostly featured women in the life sciences (64% of all female experts shown). (See Table 8.) Male experts come from more diverse fields than women — 21% of male experts are engineers, compared with just 8% of women.

TABLE 8

Gender and race of STEM occupations shown on educational programming, on air in 2023

	Life sciences	Physical sciences	Computer science	Engineering	Other field, STEM related
All women	64%	3%	8%	8%	18%
All men	40%	8%	5%	21%	26%
White women	69%	0%	6%	6%	18%
White men	44%	6%	3%	20%	28%
Women of color	43%	14%	14%	14%	14%
Men of color	0%	29%	29%	29%	14%

Note: Findings presented are from an analysis of 54 episodes of shows that aired in network E/I blocks between June 17 and July 8, 2023. In total, there were 212 STEM experts or hosts featured in these programs. The networks included CBS, ABC, NBC, Fox, and The CW.



Recommendations

What role can entertainment media play in fostering more gender inclusion in STEM? Because media representations of STEM careers impact young audiences by shaping their career ambitions, there is a critical need for media to actively and intentionally avoid inaccurate and potentially harmful stereotypes when creating stories, and instead write authentic and aspirational STEM characters.¹⁰¹ We present the following recommendations to disrupt pernicious STEM stereotypes in hopes of ushering in a more diverse STEM workforce.

1. **Diversify STEM careers for women on-screen.**

STEM careers are multifaceted and diverse, but research shows gender gaps vary greatly, depending on the field. This report revealed that in reality and on-screen, women are best represented in life sciences, such as medical careers. But showing girls and women with an array of STEM interests and careers, such as engineering, computer science, and mathematics, will broaden girls' and young women's imaginations about what is possible. Branch out beyond the life sciences when thinking about female characters' STEM interests and professions.

2. **Don't overlook representation in minor and background roles.**

Girls and young women think it's more important than ever to see women in STEM (up from 51% in 2018 to 71% in 2023). But our survey suggests they may overestimate gender imbalance in STEM on-screen relative to reality. We encourage creators to think broadly about representation and include women not only in leading and supporting roles but also in minor and background roles to further disrupt the perception that STEM professions are dominated by men.

3.

Intersectionality matters.

Our survey found that STEM characters of color were more influential for girls and young women of color than for white STEM characters. When casting female STEM characters, remember the significance of race, gender, ability, LGBTQIA+ identity, body size, and age, and portray women in STEM on-screen with diverse identities.

4.

Model work–life balance among STEM characters.

Perceptions that STEM careers are family-friendly are increasing (from 49% in 2018 to 56% in 2023) but remain relatively low. Model work–life balance to highlight the reality of STEM professionals of all genders, many of whom are primary caregivers in their families.

5.

Disrupt gender stereotypes when writing STEM characters.

STEM characters that possess mainly male-coded traits, such as reason, rationality, autonomy, and lack of empathy, reinforce gender bias in STEM portrayals. Create dynamic depictions of STEM character personalities by showing men and women with male- and female-coded traits, and recognize the value within each of these categories.

6.

Portray STEM skills as learned, not innate.

Show STEM characters learning in the classroom, making mistakes, and building skills. Our study shows that STEM was sometimes shown as an innate ability, which can reinforce the idea that STEM experts come to that skill naturally, and this notion can discourage young people from pursuing STEM if they struggle even a little. Studies show that perceiving STEM as an innate rather than learned skill disproportionately discourages female students and students of color from pursuing STEM professions. Although STEM savants can be fun characters, their overrepresentation can have negative repercussions.

7.

Write STEM characters and careers in ways that appeal to young girls and women by highlighting collaboration and the ways STEM is important to society.

A powerful way to attract girls and young women to STEM careers is by showing that these fields align with values of girls and young women. Based on findings from this study, we suggest showing STEM industries and careers as more family-friendly, STEM work as in pursuit of the greater social good, professionals working together, and environments that are safe for women and girls from marginalized communities (e.g., disabled women, women of color).

Appendix

Below is a list of films and shows that included STEM characters

FILMS

13 Hours: The Secret Soldiers Of	Baby Mama	Crazy Rich Asians
Benghazi	Bad Boys for Life	Crisis
2012	Battleship	Dallas Buyers Club
21	Beast	Dan in Real Life
21 & Over	Beautiful Boy	Dark Phoenix
6 Underground	Beauty and the Beast (live-action)	Daybreakers
A Quiet Place Part II	Big Hero 6	Deadpool
A Wrinkle in Time	Birds of Prey (And the Fantabulous	Death on the Nile
Abominable	Emancipation of One Harley Quinn)	Death Wish
Acrimony	Black Panther	Deep Water
Ad Astra	Black Panther: Wakanda Forever	Deepwater Horizon
Alien: Covenant	Black Widow	Despicable Me
Alita: Battle Angel	Bliss	Despicable Me 2
American Made	Bloodshot	Did You Hear About the Morgans?
Amsterdam	Blue Jasmine	Doctor Strange
An American Pickle	Borrego	Doctor Strange in the Multiverse of
Angels & Demons	Boss Level	Madness
Annihilation	Breakthrough	Dolittle
Anon	Bumblebee	Dolphin Tale
Ant-Man	Captain Marvel	Don't Look Up
Ant-Man and the Wasp	Captain Phillips	Don't Worry Darling
Aquaman	Captive State	Dumbo
Arctic Dogs	Chaos Walking	Dune: Part 1
Army of Thieves	Chappie	Dunkirk
Arrival	Charlie's Angels	Edge of Darkness
Artemis Fowl	Chip 'n Dale: Rescue Rangers	Edge of Tomorrow
Avatar	Clifford the Big Red Dog	Ender's Game
Avatar: The Way of Water	Cloudy with a Chance of Meatballs 2	Enola Holmes
Avengers: Age of Ultron	Cold Pursuit	Escape from Planet Earth
Avengers: Endgame	Concussion	Eternals
Avengers: Infinity War	Contagion	Everest
	Cowboys & Aliens	Everything Everywhere All at Once
		F9

Fantastic Beasts: The Secrets of Dumbledore	Horrible Bosses	Life
Fantastic Four	Hotel Transylvania 3: Summer Vacation	Lightyear
Fast and Furious Presents: Hobbs & Shaw	Hotel Transylvania: Transformania	Little
Fifty Shades Freed	How to Train Your Dragon: The Hidden World	Little Fockers
Finch	I Feel Pretty	Logan
First Man	If I Stay	Luck
Flight	Incredibles 2	Lucy
Ford v Ferrari	Independence Day: Resurgence	Lucy in the Sky
Free Guy	Inferno	Lyle, Lyle, Crocodile
G-Force	Infinite	Mamma Mia! Here We Go Again
Game Night	Interstellar	Marry Me
Game Over, Man!	Io	Mary Poppins Returns
Geostorm	Iron Man	Maze Runner: The Death Cure
Ghost in the Shell (2017)	Iron Man 2	Me Time
Ghostbusters: Afterlife	Iron Man 3	Men in Black: International
Gi Joe: Rise of Cobra	Isle of Dogs	Minions: The Rise of Gru
Gifted	Isn't It Romantic	Miracles from Heaven
Glass	It: Chapter Two	Miss Peregrine's Home for Peculiar Children
Glass Onion: A Knives Out Mystery	Jason Bourne	Missing Link
Godzilla	Jigsaw	Mission: Impossible – Fallout
Godzilla vs. Kong	Jingle Jangle: A Christmas Journey	Money Monster
Godzilla: King of the Monsters	Johnny English Strikes Again	Moonfall
Good Luck Chuck	Jolt	Morbius
Goosebumps 2: Haunted Halloween	Journey to the Center of the Earth	Mortal Engines
Green Lantern	Jumanji: The Next Level	Nerve
Greyhound	Jungle Cruise	New Year's Eve
Grindhouse	Jurassic World	Night School
Guardians of the Galaxy vol. 2	Jurassic World Dominion	Nightmare Alley
Harry Potter and the Order of the Phoenix	Jurassic World: Fallen Kingdom	No Strings Attached
Hereafter	Jurassic Park 3D	No Time to Die
Hidden Figures	Justice League	Noelle
Hitman: Agent 47	Kingsman: The Golden Circle	Non-Stop
Holmes & Watson	Knowing	Nope
Home	Kong: Skull Island	Now You See Me 2
	Lady Bird	Oblivion
	Let's Be Cops	

Ocean's 8	Sonic the Hedgehog 2	The Batman
Office Christmas Party	Soul Surfer	The Boss Baby 2: Family Business
Olympus Has Fallen	Source Code	The Bourne Legacy
Outside the Wire	Space Chimps	The Bourne Ultimatum
Over the Moon	Space Jam: A New Legacy	The Cabin in the Woods
Pacific Rim: Uprising	Spell	The Cloverfield Paradox
Paddington 2	Spider-Man: Far from Home	The Contractor
Paw Patrol: The Movie	Spider-Man: Homecoming	The Current War
Pet Sematary	Spider-Man: Into the Spider-Verse	The Day the Earth Stood Still
Planet 51	Spider-Man: No Way Home	The Debt
Playing with Fire	Spiderhead	The Expendables 3
Pokémon Detective Pikachu	Spies in Disguise	The Fabelmans
Premonition	Split	The Fantastic Four: Rise of the Silver Surfer
Prometheus	St. Vincent	Surfer
Quarantine	Star Trek	The Fourth Kind
Rampage	Star Trek Beyond	The Gentlemen
Ready Player One	Star Wars: Episode IX - The Rise Of Skywalker	The Girl in the Spider's Web
Red Tails	Stowaway	The Girl on the Train
Reminiscence	Suicide Squad	The Golden Compass
Resident Evil: Welcome to Raccoon City	Superintelligence	The Hangover 2
Rise of the Planet of the Apes	Survivor	The Hustle
Roald Dahl's Matilda the Musical	Tag	The Imitation Game
Robocop	Ted 2	The Internship
Rogue One: A Star Wars Story	Tenet	The King's Man
Ron's Gone Wrong	Terminator Salvation	The Lazarus Effect
Salt	That Awkward Moment	The Lego Batman Movie
San Andreas	The 355	The Lego Movie 2: The Second Part
Saw 3D	The Adam Project	The Lego Ninjago Movie
Scary Movie 5	The Addams Family	The Little Things
Scoob!	The Addams Family 2	The Lost City
Shaft	The Aeronauts	The Martian
Shazam!	The Amazing Spider-Man 2	The Matrix Resurrections
Sherlock Gnomes	The Angry Birds Movie	The Meg
Sherlock Holmes	The Angry Birds Movie 2	The Midnight Sky
Shutter Island	The Avengers	The Mitchells vs. The Machines
Skyscraper	The Bad Guys	The Mummy (2017)
Sonic the Hedgehog		The New Mutants

The Nutcracker and the Four Realms	Transformers: Dark Side of the Moon	Allegiance
The Pale Blue Eye	Transformers: The Last Knight	Almost Human
The Pink Panther 2	Trollhunters: Rise of the Titans	Angel From Hell
The Power of the Dog	True Grit	Animal Practice
The Predator	Twilight	APB
The Rhythm Section	Underdog	Arcane: League of Legends
The Shallows	Underwater	Atypical
The Shape of Water	Unknown	B Positive
The Sisterhood of the Travelling Pants 2	Untraceable	Believe
The Social Network	Vacation	Big Mouth
The Son of Bigfoot	Venom	Billions
The Sorcerer's Apprentice	Venom: Let There Be Carnage	black-ish
The Spongebob Movie: Sponge on the Run	Voyagers	Blindspot
The Starling	Watchmen	Blue Bloods
The Suicide Squad	We Can Be Heroes	Bob Hearts Abishola
The Time Traveler's Wife	Why Did I Get Married?	Body of Proof
The Tomorrow War	Why Him?	Bones
The Twilight Saga: Breaking Dawn – Part 2	Wind River	Brooklyn Nine-Nine
The Ugly Truth	Wonder Park	Brothers & Sisters
The Upside	Wonder Woman 1984	Bull
The Witches	World War Z	Castle
The Wolfman	X-Men: Days of Future Past	Castle Rock
The Woman in the Window	X-Men: Apocalypse	Casual
Thirteen Lives	X-Men: First Class	Chance
Thor: Love and Thunder	Zack Snyder's Justice League	Chicago Fire
Thor: The Dark World	Zero Dark Thirty	Chicago Med
Those Who Wish Me Dead	Zookeeper	Chuck
Thunder Force		Code Black
Timmy Failure: Mistakes Were Made	TV & STREAMING	Criminal Minds
To All The Boys: Always and Forever	13 Reasons Why	Criminal Minds: Beyond Borders
Togo	24	Criminal Minds: Suspect Behavior
Toy Story 4	24: Legacy	Crisis
Trainwreck	9-1-1	CSI
Transformers	9JKL	CSI: Cyber
Transformers: Age of Extinction	A Gifted Man	CSI: Miami
	A Series of Unfortunate Events	CSI: New York
	Alcatraz	CSI: Vegas

Cyberpunk: Edgerunners	House	NCIS: Hawai'i
Daniel Tiger's Neighborhood	House of Cards	New Amsterdam
Das Boot	How I Met Your Mother	New Normal
Dear White People	Hunted	Night Shift
Desperate Housewives	Instinct	No Ordinary Family
Dexter	Invincible	Numb3rs
Dopesick	Katla	Off the Map
Dr. Ken	Kevin Can Wait	Once Upon a Time
Dracula	La Brea	Ordeal by Innocence
E.R.	Last Man Standing	Outlander
Elementary	Law & Order: Special Victims Unit	Ozark
Family Guy	Law & Order: Criminal Intent	Pan Am
FBI	Law & Order: Organized Crime	Paper Girls
FBI: International	Lethal Weapon	Parks and Recreation
FBI: Most Wanted	Leverage: Redemption	Patriot
Flack	Lie to Me	Person of Interest
Flashforward	Life	Private Practice
Flashpoint	Life In Pieces	Pure Genius
Fleabag	Lost	Ramy
Forever	Lovesick	Revenge
Friends from College	Lucifer	Revolution
Fringe	MacGyver	Rick and Morty
Fuller House	Madam Secretary	Ripper Street
Future Man	Major Crimes	Rosewood
Game of Thrones	Man with a Plan	Rules of Engagement
Gary Unmarried	Manifest	Russian Doll
Go On	Marvel's Agents of Shield	Scandal
God Friended Me	Marvel's M.O.D.O.K.	SCORPION
Gotham	Marvel's Runaways	Seinfeld
Grey's Anatomy	Medium	Sense8
Grimm	Miami Medical	Shameless
Hannibal	Mindhunter	She-Ra and the Princesses Of Power
Harlem	Modern Family	So Help Me Todd
Hawaii Five-0	Mr. Robot	Solar Opposites
Heartbeat	NCIS	South Park
Heroes Reborn	NCIS: Los Angeles	Star Trek: Discovery
Hostages	NCIS: New Orleans	State of Affairs

Station 19	Under the Dome
Stranger Things	Undone
Suburgatory	Unforgettable
Supergirl	Unicorn
Sweet Tooth	Upload
Tales from the Loop	V
Terra Nova	Veronica Mars
The Big Bang Theory	Walking Dead
The Blacklist	Wisdom of the Crowd
The Blacklist: Redemption	With Love
The Boys	Without a Trace
The Dropout	Young Sheldon
The Equalizer	
The Event	
The Expanse	
The First	
The Flash	
The Goldbergs	
The Good Doctor	
The Great Indoors	
The Looming Tower	
The Marvelous Mrs. Maisel	
The Millers	
The Neighborhood	
The New Adventures of Old Christine	
The OA	
The Orville	
The Tick	
The Unit	
This Is Us	
Three Rivers	
Timeless	
Trauma	
Travelers	
Tuca & Bertie	
Twin Peaks: The Return	
Two and a Half Men	

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95. For students ages 16–24 who were directly invited to participate, we use a random sample, then enforce quotas to ensure proper representation across grade levels. For students invited to participate through their parents, we randomly sample from participants who have children. Throughout fielding, we check that the data coming in is representative of the U.S. in regards to race/ethnicity, geographic region, and income level. Once the survey is closed, we weight the data as necessary to ensure the sample used is representative of the U.S. Parents of 11- to 18-year-olds were screened to confirm the number of eligible daughters who were 11–18 years old, confirming age and education level for each. If there was more than one eligible daughter (ages 11–18), parents were able to specify which child was available and would be participating. If parents provided consent for their child, the child was asked to complete the screening questions (confirming gender, age, and education) and, if qualified, was eligible to participate in the study. Direct recruits (female students ages 16–24) were invited to participate in the survey after being screened for gender, age, enrollment, and education level. Participants who qualified and completed the survey were given the option of claiming an incentive from an external vendor.
96. The survey was administered from April 5 to April 23, 2018 by the GfK Group, a leading survey research organization.
97. The episodes selected from the series identified were the second and penultimate episode of the season from the relevant year.
98. Children’s Educational Television. Federal Communications Commission. (n.d.). <https://www.fcc.gov/consumers/guides/childrens-educational-television>
99. Due to additional regulations regarding commercial time limitations for audiences under the age of 12, most broadcasters produced programming aimed at children ages 13–16. Notably, this is also the age when young girls often lose interest in STEM. To fulfill these federal obligations, broadcasters have created E/I programming blocks that typically air on Saturday mornings. These blocks include: CBS Dream Team (CBS), The More You Know (NBC), One Magnificent Morning (The CW), Weekend Adventure (ABC), and Xploration Station (Fox).
100. Hall, J. & C. Suurtamm. (2020). “Numbers and Nerds: Exploring Portrayals of Mathematics and Mathematicians in Children’s Media.” *International Electronic Journal of Mathematics Education*, 15. Available at <https://files.eric.ed.gov/fulltext/EJ1254839.pdf>
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About the Geena Davis Institute

Since 2004, the Geena Davis Institute has worked to mitigate unconscious bias while creating equality, fostering inclusion and reducing negative stereotyping in entertainment and media. As a global research-based organization, the Institute provides research, direct guidance and thought leadership aimed at increasing representation of marginalized groups within six identities: gender, race/ethnicity, LGBTQIA+, disability, age, and body type. Because of its unique history and position, the Institute can help achieve true on-screen equity in a way that few organizations can. Learn more at seejane.org/.

About IF/THEN®

Founded in 2019, IF/THEN®, an initiative of Lyda Hill Philanthropies, seeks to further advance women in science, technology, engineering, and math (STEM) by empowering current innovators and inspiring the next generation of pioneers. Rooted in a firm belief that there is no better time to highlight positive and successful female professional role models, IF/THEN® is designed to activate a culture shift among young girls to open their eyes to STEM careers by: (1) funding and elevating women in STEM as role models; (2) convening cross-sector partners in entertainment, fashion, sports, business, and academia to illuminate the importance of STEM everywhere; and (3) inspiring girls with better portrayals of women in STEM through media and learning experiences to pique their interest in STEM careers. Putting words to action, the initiative has launched an Emmy-nominated television series, *Mission Unstoppable*, created the IF/THEN® Collection — the world’s largest free resource library of photos and videos of diverse women in STEM — and launched “#IfThenSheCan – The Exhibit,” a monumental installation of 120 life-sized 3D-printed statues of real women STEM professionals. IF/THEN® content has garnered hundreds of millions of views from women and girls, furthering the approach that if you support women and girls in STEM, then you can change the world.

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