Geena Davis Institute on Gender in Media
If she can see it, she can be it.™

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AN INITIATIVE OF THE LYDA HILL FOUNDATION

PORTRAY HER:

Representations of Women STEM Characters in Media

THE LYDA HILL FOUNDATION & THE GEENA DAVIS INSTITUTE ON GENDER IN MEDIA

MESSAGE FROM GEENA DAVIS

At the Geena Davis Institute on Gender in Media, we've conducted numerous studies over the years showing that diverse and high-quality portrayals of women and girls are quite simply missing from children's media. This has a real impact on young viewers' ideas about themselves and the occupations they pursue.

Nowhere is this phenomenon more apparent than in the Science, Technology, Engineering, and Math (STEM) fields, where only one-quarter of scientists and engineers in the United States are female. The factors that contribute to women's slim presence in the sector are undoubtedly complex, but we know that media play a contributing role. In 2012, my Institute analyzed occupations in children's media and found that for every 15 male characters shown in STEM jobs there was only one female character portrayed in a STEM profession. When girls in their formative years don't see female characters on screen as biochemists, software developers, engineers, or statisticians, they are less likely to imagine or pursue those career paths for themselves.

However, when girls do see women in STEM in media, it has a significant impact. Our 2018 study, "The Scully Effect," looked at the influence of The X-Files' protagonist Dana Scully on girls and women entering the STEM field. Nearly two-thirds of women working in STEM today say that Scully served as their personal role model and increased their confidence to excel in a male-dominated profession. In other words, as we say, "If she can see it, she can be it."

Because of our early focus on this area, we've been eager to examine this issue more closely and give STEM representation in children's media the full attention it deserves. As Michelle Obama says, "We need all hands on deck. And that means clearing hurdles for women and girls as they navigate careers in science, technology, engineering, and math."

That's why I was thrilled with the opportunity to partner with Lyda Hill, an entrepreneur and philanthropist with a passion for science and math, and a spirit for bucking the status quo, on this groundbreaking new study. With her support, we have conducted an extensive ten year content analysis of STEM characters in entertainment media and a nationally representative survey of girls and young women. These two methods enabled us to assess how STEM professions are represented in media, and how these representations (and messages from society more broadly) affect girls' perceptions of and participation in STEM. The results published here show once again the profound role that media play in shaping young people's aspirations and career paths.

Increasing media depictions of women in STEM is easy to do, and provides a big bang for the buck. There are concrete steps that those of us within the entertainment industry can take to encourage more girls and women to pursue jobs in this important sector, raising up all of those with the potential to become our future STEM visionaries and innovators.

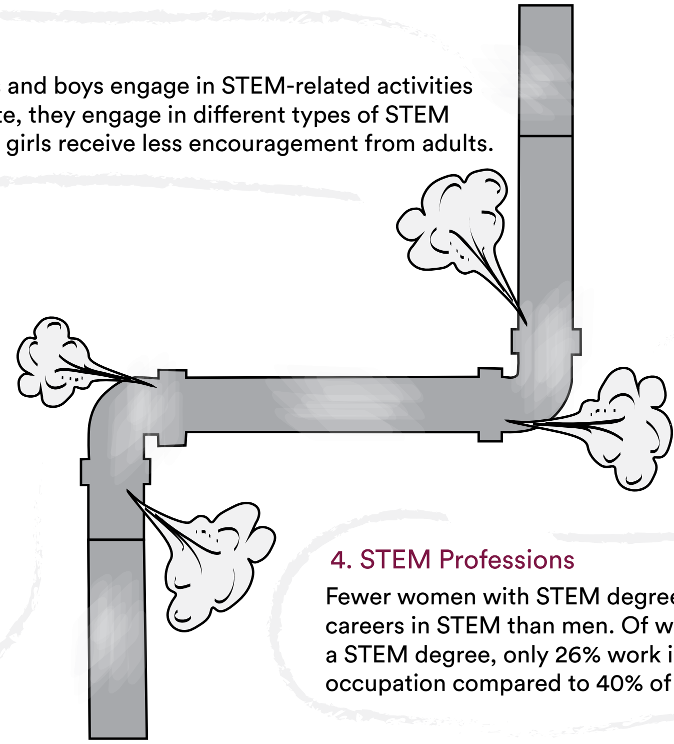
GEENA DAVIS

THE LEAKY PIPELINE

Three decades of research on gender disparities in STEM have produced the apt metaphor of a "leaky pipeline" in which girls and women leave STEM at every key joint.[1] The "joints" in this metaphor represent childhood, high school, college, and STEM professions.

1. Childhood

Although girls and boys engage in STEM-related activities at a similar rate, they engage in different types of STEM activities, and girls receive less encouragement from adults.



2. High School Years

Interest in STEM careers remains stable for boys throughout high school (39.5% for first-year students compared to 39.7% for seniors), but for girls, it starts at a much lower level and declines during high school (15.7% for first-year students compared to 12.7% for seniors).[2]

3. College Years

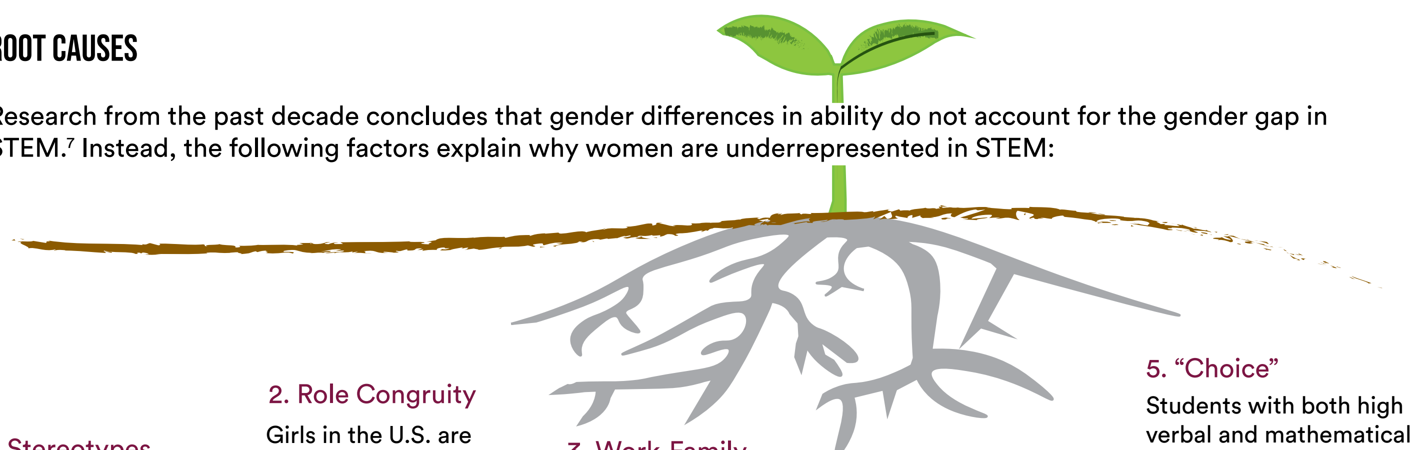
High school girls and college women outperform boys and men in math classes,[3] but college women are significantly less likely than men to choose STEM majors, and remain underrepresented in the number of bachelor's degrees earned in STEM.[4] Over 6.7 million men in the U.S. have a degree in STEM compared to 2.5 million women.[5]

4. STEM Professions

Fewer women with STEM degrees pursue careers in STEM than men. Of women with a STEM degree, only 26% work in a STEM occupation compared to 40% of men.[6]

ROOT CAUSES

Research from the past decade concludes that gender differences in ability do not account for the gender gap in STEM.[7] Instead, the following factors explain why women are underrepresented in STEM:



1. Stereotypes

Jennifer Saucerman and Kris Vasquez find that "parents, teachers, toys, social norms, and media representations all play a part in discouraging girls and women from entering into STEM fields."[8] These people and institutions reinforce the stereotype that STEM is for men.

2. Role Congruity

Girls in the U.S. are raised with more of a community orientation than boys,[9] which means they are more likely to prioritize working with others and helping others.[10] Community-oriented individuals avoid STEM professions because they are not seen as meeting the goals of collaborative work,[11] altruism,[12] and benefiting others.[13]

3. Work-Family Challenges

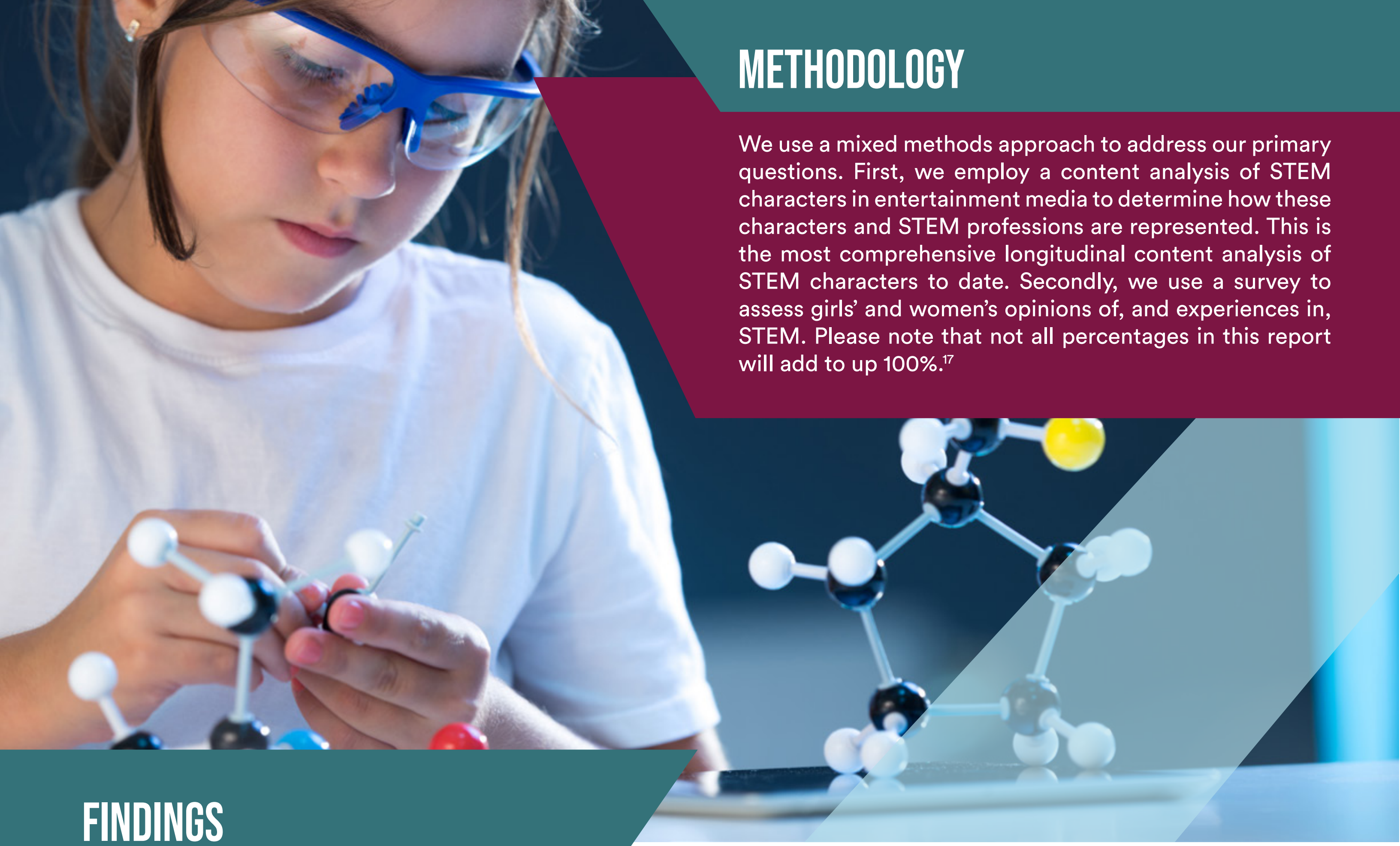
Adolescent girls are more likely than adolescent boys to value work that enables them to spend time with family,[14] and this value orientation carries forward into the college years and into professional life. High school students who desire a family-flexible job tend to avoid STEM occupations because they perceive them to be family-inflexible.[15]

4. Gender Discrimination

Women headed to college tend to avoid STEM fields, not because they require more math and science, but because they think they will encounter gender discrimination in STEM professions.

5. "Choice"

Students with both high verbal and mathematical skills have greater career options to choose from, and people with both skill sets tend to choose non-STEM careers. Girls with high math competency are more likely than boys with high math competency to also have high verbal ability, so they have more career choices than the typical mathematically inclined boy.[16]



METHODOLOGY

We use a mixed methods approach to address our primary questions. First, we employ a content analysis of STEM characters in entertainment media to determine how these characters and STEM professions are represented. This is the most comprehensive longitudinal content analysis of STEM characters to date. Secondly, we use a survey to assess girls' and women's opinions of, and experiences in, STEM. Please note that not all percentages in this report will add to up 100%.[17]

FINDINGS

PORTRAYALS OF STEM CHARACTERS IN MEDIA

Our content analysis addressed the primary question of whether entertainment media primarily reinforces or interrupts portrayals and stereotypes of gender and STEM that serve to discourage girls/women from going into STEM professions. We found mixed results: entertainment media both projects and disrupts damaging gender messages about STEM.

Negative Media Messages About STEM

Media portrayals of STEM characters send the profoundly negative message that STEM professions are for white men. This narrow representation has not improved in the last decade. Of all STEM characters, men outnumbered women nearly two-to one (62.9% compared to 37.1%). The vast majority of STEM characters in entertainment media were White (71.2%), while fewer were Black (16.7%), Asian/Asian-American (5.6%), Latinx (3.9%), and Middle Eastern (1.7%).

In the past decade, entertainment media also reinforced stereotypes about which STEM fields are appropriate for women. Fewer women STEM characters were portrayed as physical scientists (6.4% compared to 11.8%), engineers (2.4% compared to 13.7%), or in computer occupations (8.6% compared to 11.5%) than men STEM characters.

Entertainment media also sends a discouraging message to girls and young women that they will have to sacrifice their personal and family life if they go into a STEM profession. Nearly 43% of STEM characters were shown as sacrificing their personal life in order to work in STEM.

Positive Media Messages About STEM

One postive finding of this study is that women were just as likely to be portrayed as leaders in a STEM profession as men (50.5% and 50.0%, respectively).

Another positive finding is that entertainment media shows women STEM characters as equally or more competent, intelligent, and personally empowered in their profession as men STEM characters.

A third positive finding is that entertainment media mostly presents STEM work as collaborative. Two-thirds of STEM characters were shown working in collaboration with others (64.5%) rather than working alone (9.4%) or a combination of both (7.7%).[18]

Our last positive finding from the content analysis is that entertainment media shows STEM work as mostly helping others (64.0%) rather than being driven by self-interest (14.4%). This is especially the case for STEM work performed by women characters.

SURVEY OF GIRLS & WOMEN

The major findings from our survey are broken down into two sections: attitudes and intentions toward STEM, and factors that determine girls' and women's pursuit of STEM.

Attitudes and Intentions Toward STEM

Girls and young women in our study hold moderately positive attitudes toward STEM. They rated technology and science more positively than engineering and math. Students who identify as "other" in terms of race (a category that includes Asian-Americans), had more favorable attitudes toward STEM than White, Black or Latinx students.

When it comes to intention to pursue a STEM career, one-third of girls/women said they have considered a STEM career, but only about a quarter said they will actually go into STEM. Intention to go into STEM varied by race. Girls/women who identify as "other" in terms of race reported the highest rate of intention to go into STEM, while Black girls/women reported the lowest rate of intention to go into STEM.

Interest in STEM fields is higher during middle school and lowest in high school. Not only does interest drop during high school, but negative attitudes toward STEM increase at this time. Although interest in STEM does bounce back somewhat in college, college women reported higher insecurity about sexism and gender-specific challenges in STEM occupations.

A vast majority of girls/women perceived STEM work as collaborative (rather than solo) and community-serving (rather than self-interested), which is a positive finding given that girls/women place a high priority on these aspects of their work life. Just under half of girls/women perceive STEM work as family-flexible, which may discourage them from pursuing this career path.

Factors That Influence Pursuit of STEM

Nearly four-in-five study participants (82.7%) said it was important to see women STEM characters in film and television. The vast majority of girls and women who plan to pursue STEM said that popular STEM characters in entertainment media inspired them to pursue a STEM major or career.

Girls/women are less likely to go into STEM if they perceive STEM work to be solo rather than collaborative, and if they believe that women face sexism in STEM.

Girls/women are more likely to go into STEM if they perceive of STEM as helping others rather than being self-serving, and if they see STEM as family-flexible. Girls/women are also more likey to pursue a career in STEM if they personally know someone in STEM, have a STEM role model, and have teachers, friends and family members who encouraged them to pursue STEM.

RECOMMENDATIONS

Based on previous research coupled with our findings, we propose the following interventions to increase the participation of girls and women in STEM majors and careers:

- Improve media representations of STEM characters when it comes to gender and race. This study demonstrates that media is influential in shaping attitudes toward STEM, but content producers continue to disproportionately represent STEM characters as white men, especially leading characters. Special attention should be paid to increase the representation of women and people of color as STEM characters, and to improve the ways women STEM characters are portrayed.
- Cultivate girls' interest in math and science from an early age through media role models, parents, educators, and mentors. Having supportive mentors, teachers, friends, and family members improves girls' interest in and intention to pursue STEM.
- Implement early childhood interventions to combat stereotypes about science as a pursuit for men, and cultural misperceptions that girls and women have a lower aptitude for STEM.
- Retain women in STEM through equitable hiring, pay, and promotion practices, and by addressing workplace bias (gender discrimination and sexual harassment) as well as implementing flexible work-family policies.

FOOTNOTES

1. Diekman, A.B., Weisgram, E.S., and Belanger, L. (2015). "New Routes to Recruiting and Retaining Women in STEM: Policy Implications of a Communal Goal Congruity Perspective." Social Issues and Policy Review, 9(1): 52–88.

2. Sadler, P. M., Sonnert, G., Hazari, Z. and Tai, R. (2012). "Stability and Volatility of STEM Career Interest in High School: A Gender Study." Science Education, 96(3): 411–427.

3. Cheryan, S. (2012). "Understanding the Paradox in Math-Related Fields: Why Do Some Gender Gaps Remain While Others Do Not?" Sex Roles, 66(3-4): 184–90.

4. Chen, X., and Weko, T. (2009). Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education. U.S. Department of Education, National Center for Education Statistics.

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6. Ibid.

7. Ceci, S. J., Williams, W. M., and Barnett, S. M. (2009). "Women's Underrepresentation in Science: Sociocultural and Biological Considerations." Psychological Bulletin, 135(2): 218–261.

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13. Diekman, A. B., Brown, E. R., Johnston, A. M., and Clark, E. K. (2010). "Seeking Congruity Between Goals and Roles: A New Look at Why Women Opt Out of Science, Technology, Engineering, and Mathematics Careers." Psychological Science, 21(8): 1051–1057.

14. Weisgram, E. S., Bigler, R. S., and Liben, L. S. (2010). "Gender, Values, and Occupational Interests Among Children, Adolescents, and Adults." Child Development, 81(3): 778–796.

15. Frome, P. M., Alfeld, C. J., Eccles, J. S., and Barber, B. L. (2008). "Is the Desire for a Family-Flexible Job Keeping Young Women out of Men-Dominated Occupations?" In Gender and Occupational Outcomes: Longitudinal Assessments of Individual, Social, and Cultural Influences (pp. 195– 214). Washington, DC: American Psychological Association

16. Wang, M.T., Eccles, J. S., and Kenny, S. (2013). "Not Lack of Ability but More Choice: Individual and Gender Differences in Choice of Careers in Science, Technology, Engineering, and Mathematics." Psychological Science, 24(5): 770–775.

17. Responses to most questions on surveys and content analyses do not add up to 100% for a variety of reasons. First, on surveys, some respondents may choose not to answer the question. Secondly, some respondents may have answered "other" to the question because the response categories did not fit their situation (e.g., gender non-conforming individuals would mark "other" instead of "male" or "female"). For content analysis, the percentages may not total 100% because the character may not fit the standard categories (e.g., an extraterrestrial character who does not have an identifiable race would be classified as "other").

18. The remaining 18.4% of characters were not shown working.