



STEM and CTE

BACKGROUND ON GENDER EQUITY IN STEM AND CTE

Gender biases and sex stereotypes persist at all levels of education, and particularly hinder efforts to achieve gender equity in science, technology, engineering, and math (STEM) and career and technical education (CTE) fields. Ensuring that girls and women have equal access to STEM and CTE is critical to remaining globally competitive in a world where technological advancement is the cornerstone of innovation and to building a workforce that can meet the challenges of the future.

CTE prepares both youth and adults for a wide range of careers. These careers may require varying levels of education, including apprenticeships, industry-recognized credentials, postsecondary certificates, and two- and four-year degrees. CTE begins early and carries through higher education. It is offered in middle schools, high schools, career and technical centers, community and technical colleges, and other postsecondary institutions. Organized around 16 career clusters, those considered nontraditional¹ for women and girls at the postsecondary level include Architecture & Construction (14 percent); Information

Technology (25 percent); Manufacturing (16 percent); STEM (27 percent); and Transportation, Distribution & Logistics (14 percent).²

The gender gap that exists in the STEM workforce cannot be blamed on differences in academic preparation. Girls and boys perform similarly on national assessments in math and science exams given in middle and high school.³ However, disparities in STEM interests appear when students enroll in math and science courses in high school, with more girls taking AP exams in biology and chemistry versus physics and computer science.⁴ These disparities are also seen in the lower levels of interest girls express in pursuing college degrees in certain STEM fields, including engineering and computer science,⁵ where only 21 percent of bachelor's degrees are earned by women.⁶ A recent longitudinal study found that girls were more likely than boys to report a decrease in intentions to pursue a STEM career over the course of their high school career.⁷ Factors such as gender stereotypes held by parents and teachers and lower levels of STEM confidence and doubts about STEM competence among girls, despite their academic

achievements in math and science, continue to prevent women from pursuing STEM majors in college.⁸

Biases and stereotypes continue to plague women in college and the workplace, creating what many researchers have found to be an unwelcoming and uncomfortable environment. The climate and culture in STEM spaces, including in disciplines such as biology and chemistry, where women are not underrepresented, is often a challenge for women, who report being underestimated, underappreciated, and having their contributions ignored.⁹ Women in academic STEM workplaces are significantly underrepresented in faculty ranks, particularly in leadership roles.¹⁰ For example, in 2020, only 19 percent of tenured and tenure-track engineering faculty were women, and only 36 percent of tenured and tenure-track women faculty were classified as full professors compared to 51 percent of men.¹¹ Sexual harassment has also negatively impacted women's advancement in academic sciences, engineering, and medicine, resulting in a significant loss of talent in these fields.¹²

Developments Since 1972

Title IX has been instrumental in providing increased access to STEM and CTE courses and activities for girls and women at all levels of education.

STEM: Since Title IX's passage, federal agencies have taken measures to ensure that educational institutions are providing equal opportunities to STEM education, regardless of gender, as well as addressing inequities that exist in promotion, compensation, and access to research resources for academic faculty. One of the strongest responses to addressing inequities in STEM has been an increased focus by the National Academies

of Sciences, Engineering, and Medicine on sexual harassment and discrimination in STEM, promoting the position that ethical conduct and investigation policies among associations and federal agencies that award research grants and professional recognitions to STEM researchers and practitioners be considered as equally important as efforts to address research misconduct.¹³ Of note are the National Science Foundation and the National Institute of Health's policies that require reporting sexual harassment findings within their funded research programs on campuses, in national laboratories, and similar workplaces.¹⁴

DEVELOPMENTS SINCE 1972 *continued*

However, there are still inconsistencies across federal agencies regarding how they monitor Title IX compliance in STEM programs. The Government Accountability Office recently found that some agencies lack procedures for sexual harassment complaints and are likely mishandling complaints they do receive.¹⁵ In addition, despite the efforts of federal agencies and professional organizations to promote safe and inclusive educational spaces, many students and STEM educators still lack knowledge of their rights under Title IX. Increasing awareness of the applicability of Title IX can help to close the gender gap in STEM. Restoring and strengthening Title IX protections that keep women and girls safe and supported in their STEM educational pathways, and ensuring that they understand how to report their harassment and discrimination complaints, will help close the STEM gender gap.

CTE: CTE has a long history of sex segregation, starting in 1917 when the first Vocational Education Act was passed. Girls were only allowed to take home economics, and boys took agriculture and trade or industrial arts. Progress toward gender equity in CTE has been slow with the passage of Title IX in 1972 and all the federal vocational education acts that followed containing provisions focused on gender equity since 1978. Since 1979, the Methods of Administration Guidelines (MOA Guidelines) have required state education agencies responsible for CTE to monitor local education agencies' adherence to civil rights obligations.¹⁶ In 2020, under the Trump administration, the Department of Education's Office for Civil Rights (OCR) and Office for Career Technical and Adult Education (OCTAE) released a memo updating the MOA Guidelines to include OCTAE as a partner and to "harmonize their civil rights compliance activities under the MOA Guidelines with their equity and civil rights activities under the 2018 Perkins Act reauthorization."¹⁷ In 2016, under the Obama administration, the Department of Education issued a guidance document on how schools can comply with their legal obligations to

remedy sex discrimination in CTE programs, including regarding recruitment and promotional activities, admissions, counseling, pregnancy and parental status, and sex-based harassment.¹⁸ However, the Trump administration rescinded this guidance in 2020, creating confusion among schools about the supports and strategies they could be implementing to support the inclusion of women and girls in CTE.¹⁹

The current federal law that funds CTE is the Strengthening Career and Technical Education for the 21st Century Act of 2018 (Perkins V). Perkins V includes many provisions that support gender equity in CTE, including, most importantly, an accountability measure that requires states and localities to increase the percentage of "concentrators"—high school and postsecondary students of the underrepresented gender who have taken a minimum number of courses in a nontraditional CTE program.²⁰ Progress over the past 10 years has been steady in some fields and stagnant in others, pointing to gender equity as a continuing problem in CTE and STEM.

CTE programs that lead to nontraditional careers for women hold tremendous potential for shrinking the wage gap. Women continue to be clustered in the lowest-paying occupations, making economic self-sufficiency impossible to achieve, especially for single parents.²¹ COVID-19 has only exacerbated this problem with women, particularly women of color, facing higher rates of job loss than men in 2020.²² The promise of Title IX was to expand opportunity in CTE by ending discrimination and expanding career choices for all students regardless of sex. Unfortunately, the social stereotypes and stigmas that our culture continues to reinforce has not fulfilled this promise (see [Sex-Segregated Education](#)). Systemic barriers and implicit bias based on gender, race, disability, class continue to play out in schools and colleges. The hurdles that women face keep them from achieving their full earning potential, with implications for the nation's economy as a whole.

Recommendations

The federal agencies, including the Department of Education, should:

- Coordinate with all federal agencies that enforce Title IX (e.g., Department of Education, Department of Labor, Department of Energy, National Science Foundation, Health and Human Services) to ensure women and girls do not face harassment or discrimination as students, researchers, or instructors in STEM and CTE and that their discrimination complaints are adequately addressed.
- Restore the 2016 CTE guidance clarifying that under Title IX, schools can provide targeted programming to women in fields where they're underrepresented, including STEM, even if those disparities cannot be traced to specific instances of unlawful discrimination.
- Include data in the Department of Education's Civil Rights Data Collection and other federal data collections on the participation of women and girls in STEM and CTE programs, disaggregated by race, disability, and other demographic categories.
- Ensure that the OCTAE is adequately supporting states to: 1) collect and make publicly available accurate enrollment, concentrator, and accountability data that is disaggregated and cross-tabulated by gender, race, and each of the special populations as required in Perkins V; 2) set rigorous accountability targets for increasing women's and girls' participation in nontraditional CTE programs; 3) report on any equity gaps in participation and performance on the State-determined levels of performance; and 4) develop comprehensive improvement plans to address any identified gaps.
- Conduct research on the implementation of the MOA Guidance under the new partnership that OCR has made with OCTAE to determine if this is leading to more rigorous adherence to civil rights laws and remedying of sex discrimination in CTE.
- Ensure that women are fairly awarded support for STEM research from federal research agencies.

Schools should:

- Strive to attract and retain women in apprenticeship and pre-apprenticeship programs in construction, skilled trades, and other fields with high projected skill shortages by targeting recruitment efforts, training, and support systems to their needs.
- Invest and support implementation of programs that engage students in exploring nontraditional careers that lead to their participation in CTE.
- Conduct professional development with educators at all levels to create equitable learning environments and school culture that supports underrepresented student access and success in STEM and CTE.

Congress should:

- Increase federal investments in research on effective strategies for increasing girls' and women's participation and achievement in STEM and nontraditional CTE programs.
- Encourage more equitable access to public and private capital that nurtures innovation in STEM and CTE.
- Increase federal funding for research into sexual harassment and gender harassment in the STEM workforce, including the skilled trades, as well as interventions to reduce occurrences and address the negative consequences of harassment.

- 1 “Nontraditional” fields are defined by the Strengthening Career and Technical Education for the 21st Century Act (Perkins V) as career fields where less than 25 percent of the individuals employed are men or women.
- 2 Advance CTE: State Leaders Connecting Learning to Work, *Career Clusters* (last visited Apr. 15, 2022), <https://careertech.org/career-clusters>.
- 3 See Department of Education, Institute of Education Sciences, National Center for Education Statistics, *National Assessment of Educational Progress*, <https://nces.ed.gov/nationsreportcard>.
- 4 College Board, *Program Summary Report* (2020), <https://secure-media.collegeboard.org/digitalServices/pdf/research/2020/Program-Summary-Report-2020.pdf>.
- 5 University of California, Los Angeles, Higher Education Research Institute, *The American Freshman: National Norms 12* (2020), <https://www.heri.ucla.edu/monographs/TheAmericanFreshman2019.pdf>.
- 6 Department of Education, Institute of Education Sciences, National Center for Education Statistics, *Digest of Education Statistics* (20291), https://nces.ed.gov/programs/digest/2021menu_tables.asp.
- 7 Laura Holian & Emily Kelly, e National Center for Education Statistics, *STEM Occupational Intentions: Stability and Change Through High School* (June 2020), <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020167>.
- 8 Peter Meiksins et al., *Women in Engineering: A Review of the 2020 Literature*, 67(2) SWE Magazine (Fall 2021), <https://magazine.swe.org/women-in-engineering-a-review-of-the-2020-literature>.
- 9 *Id.*
- 10 Laura McCullough, *Proportions of women in STEM leadership in the academy in the USA*, 10(1) Education Sciences 4-5 (2020), <https://eric.ed.gov/?id=EJ1241142> (Tables 3 and 4).
- 11 American Society for Engineering Education, *Engineering & Engineering Technology by the Numbers* 52, 53, 56 (2021), <https://ira.asee.org/wp-content/uploads/2021/11/Total-by-the-Number-2020.pdf> (Table 80 shows 18.5% of STEM tenured/tenure-track faculty are women. Tables 79 and 85 were used to calculate percent of women and men classified as full professors.).
- 12 National Academies of Sciences, Engineering, and Medicine, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine* (2018), <https://doi.org/10.17226/24994>.
- 13 *Id.* at 83.
- 14 E.g., National Science Foundation, *Stop Harassment*, <https://www.nsf.gov/od/oecr/harassment.jsp>; National Institutes of Health, *For NIH Awardee Organizations and Those Who Work There* (last updated Sept. 17, 2018), <https://www.nih.gov/anti-sexual-harassment/nih-awardee-organizations-those-who-work-there>.
- 15 Government Accountability Office, *Sexual Harassment in STEM Research: Agencies Have Taken Actions, but Need Complaint Procedures, Overall Plans, and Better Collaboration* (Mar. 19, 2020), <https://www.gao.gov/products/gao-20-187>.
- 16 Department of Education, *Guidelines for Eliminating Discrimination and Denial of Services on the Basis of Race, Color, National Origin, Sex, and Handicap in Vocational Education Programs* (Mar. 21, 1979), 34 C.F.R. § 100, App’x B.
- 17 Department of Education, *Updated Procedures for Preparing the Methods of Administration (MOA) Described in the Vocational/Career and Technical Education Guidelines* (Feb. 6, 2020), <https://www2.ed.gov/about/offices/list/ocr/letters/memo-20200206-moa.pdf>.
- 18 Department of Education, *Dear Colleague Letter on Gender Equity in Career and Technical Education* (issued June 15, 2016; rescinded Aug. 26, 2020), <https://www2.ed.gov/about/offices/list/ocr/letters/colleague-201606-title-ix-gender-equity-cte.pdf>.
- 19 *Id.*
- 20 20 U.S. Code § 2302(12).
- 21 Deborah Rho, *The Gender Policy Report, What Causes the Wage Gap?* (Feb. 24, 2021), <https://genderpolicyreport.umn.edu/what-causes-the-wage-gap>.
- 22 Center for American Progress, *When Women Lose All the Jobs: Essential Actions for a Gender-Equitable Recovery* (Feb. 1, 2021), <https://www.americanprogress.org/article/women-lose-jobs-essential-actions-gender-equitable-recovery>.