

FAST FACTS

All Ohio public colleges and universities will offer pathways in mathematics that help students succeed, increase the percentage of students completing degree programs and promote the effective transfer of credits for students moving from one institution to another.

Mathematics: Excellent career opportunities for women

Actress **Mayim Bialik**. Flickr co-founder **Caterina Fake**. Astronaut **Sally Ride**. Ethnologist **Jane Goodall**. Environmentalist **Rachel Carson**. And **Maryam Mirzakhán**, the first woman to win the prestigious Fields Medal.

Six distinguished women in six different fields of professional endeavor. Yet, all of them share something in common: academic training in mathematics or a field requiring intensive use of mathematics.

Over the past 50 years, there has been exponential growth in women's representation in scientific careers. Today, half of all medical degrees and Ph.D.s in the life sciences are earned by women. Yet, in the most mathematically intensive fields – engineering, physics, mathematics, chemistry, economics and computer science – women's progress has been much less dramatic.(3)

In the nation's top 100 universities, fewer than one out of six tenure-track positions in mathematics-intensive disciplines is occupied by a woman.(4) Why this underrepresentation in academia's most mathematics-intensive disciplines? Several explanations have been advanced.

Gender differences in math and spatial ability. There are no systematic gender differences in mean mathematical abilities, although test scores reveal a slightly larger number of men on both tails of the distribution. These variations cannot explain most of the gender gap.(3)

Sex discrimination. This is the most contentious explanation – that discrimination in hiring, promotion and funding accounts for the dearth of women. While research shows that the current shortage cannot be entirely attributed to current practices, historic practices may be explained in such terms, with lingering legacy effects that impede progress, such as departmental culture in attracting and retaining female STEM majors.(5)

Gender differences in interest, preferences and lifestyle choices. Women's choices – freely made or constrained by society – appear to be the primary cause of underrepresentation. Women choose at a young age not to pursue math-intensive careers, perhaps because parents and teachers tell them that “math is for boys.” By adolescence, girls express desires to be medical doctors, veterinarians and biologists – not engineers or physicists. Since females are more likely to have superior verbal abilities, they have more career choices than males.(4)

Most STEM fields are excellent career choices for women

Men outnumber women in most STEM careers. But that doesn't mean it's hard for women to get jobs and succeed in those fields. However, there are some challenges women will face.

CHALLENGE: There is a shortage of mentors for women in STEM fields – people to show them the ropes and promote their accomplishments, one of the legacy effects of historic discriminatory practices. **SOLUTION:** Women who can't find a mentor at work can join a professional association – e.g., Association for Women in Mathematics or the Association for Women in Science – which offer networking opportunities.

CHALLENGE: Women may lack acceptance from coworkers/supervisors. **SOLUTION:** Seek employment with those that have female-friendly policies and practices. Many companies understand that it is profitable to recruit talented women, treat them fairly, move them into leadership positions and offer flexible work or mentoring programs.

CHALLENGE: Coping with gender differences in the workplace isn't easy. Men and women have different interaction styles that play themselves out at work.

SOLUTION: Women should educate themselves about gender differences in communication; shouldn't wait to be asked before offering an opinion and should learn how to handle mistakes, blame and guilt in a male-dominated workplace. For more guidance, see Hill, Corbett and Rose (2010), or visit the websites of the women's professional organizations identified above.

Selected Resources

1. Boland, Pat, ed. (1995) *Gender-Fair Math*. Equity in Education Series. Office of Educational Research, U.S. Department of Education
2. Ceci, S., and Williams, W. (2010). *Sex Differences in Math-Intensive Fields*. Association for Psychological Science. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2997703/>
3. Ceci, S., Williams, W., and Barnett, S. (2009) "Women's Underrepresentation in Science: Sociocultural and Biological Considerations". *Psychological Bulletin*, American Psychological Association. <https://www.human.cornell.edu/hd/upload/Ceci-Williams-Barnett-2009.pdf>
4. Hill, C., Corbett, C., and Rose, A. (2010) "Why So Few? Women in Science, Technology, Engineering, and Mathematics". American Association of University Women. <http://www.aauw.org/files/2013/02/Why-So-Few-Women-in-Science-Technology-Engineering-and-Mathematics.pdf>
5. Luscombe, B. (2010). "Explaining Complicated Women + Math Formula." *Time Magazine*. <http://healthland.time.com/2010/10/28/the-complicated-women-math-formula/>
6. Maraffi, M. (2015). *Girls' Attitudes, Self-Expectations, and Performance in Math: An Annotated Bibliography*. Drexel University. <http://mathforum.org/sarah/Discussion.Sessions/biblio.attitudes.html>
7. Ohio Department of Education (2015). "Math Graduation Requirements". <http://education.ohio.gov/Topics/Ohio-s-New-Learning-Standards/Mathematics/Mathematics-Graduation-Requirements>
8. Park, A. (2008). "The Myth of the Math Gender Gap," *Time Magazine*. <http://content.time.com/time/health/article/0,8599,1826399,00.html>
9. Rosser, S., ed. (1995). *Teaching the Majority: Breaking the Gender Barrier in Science, Mathematics, and Engineering*. Teachers College Press.
10. U.S. Department of Education (2012). "Gender Equity in Education: A Data Snapshot". www2.ed.gov/ocr/docs/gender-equity-in-education-datanotes.pdf

Women ask about mathematics and careers . . .

+ I've always been good in math and my parents want me to major in engineering when I enter college. Are there any good alternatives?

An engineering degree opens the door to many exciting career options, but it's certainly not the only major available for women who enjoy mathematics and science. Ability in math and science is the cornerstone of many health care jobs – doctors, dentists, nurse practitioners and medical researchers. Similarly, a strong mathematics program can help you succeed in business. Architects, accountants, statisticians, financial planners, software engineers, database administrators and hardware designers must have a good grasp of basic and advanced math techniques and provide alternatives to careers in engineering. With a mathematics degree, your options will be unlimited.

+ Which math courses should I take in high school if I'm planning to major in a STEM-related field in college?

According to Ohio's current high school graduation requirements, students may take any combination of high school and/or college level mathematics courses to earn the requisite four credits of high school mathematics as long as one of the credits is Algebra II or its equivalent. The fourth math course can, but does not need to be, higher than Algebra II or its equivalent. Suggested fourth math courses are pre-calculus, statistics, transitions to college algebra, computer science, AP Mathematics courses, trigonometry, quantitative reasoning and many Career-Technical Education courses. Since mathematics is a basis for many STEM careers, it would be best to take the highest level of math that you are able to fit into your schedule.

+ I want to pursue a STEM career, but is there any way that I can avoid taking calculus?

Probably not. Calculus is a fundamental part of engineering, physics, chemistry, computer science, and economics. Most STEM degrees will require a minimum of one or two semesters of calculus, so taking it in high school will be a good preparation for the math courses that you will need in college.

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