# STEM EDUCATION

# LECTURE: 8

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# TOPICS

- Diversity in STEM

- Gender Disparity in STEM

# What is Diversity in STEM?

❖ Diversity in STEM refers to the *inclusion of individuals* from various *backgrounds*, including *race*, *ethnicity*, *gender*, *sexual orientation*, *disability status*, and *socioeconomic status*, in STEM education and careers (National Academies of Sciences, Engineering, and Medicine [NASEM], 2021).

❖ A diverse STEM workforce fosters creativity, enhances problem-solving, and ensures that scientific advancements benefit all segments of society.



**Diversity STEM**

# Why is Diversity Crucial for Innovation and Progress in STEM Fields?



- Research shows that diverse teams *produce more innovative solutions* (Page, 2017). Homogeneous groups often suffer from *groupthink*, whereas diverse teams bring different perspectives that lead to *breakthroughs*.

- Additionally, diversity in STEM ensures that taken initiatives addresses the needs of diverse populations. For example, medical research with historically underrepresented women and minorities, leading to gaps in treatment efficacy (Obermeyer et al., 2019).

# Underrepresented Groups in STEM Education

▪ **Racial and Ethnic Minorities in STEM:**

Despite making up a growing portion of the U.S. population, Black, Hispanic, and Indigenous professionals remain underrepresented in STEM.

In United Kingdom,

- 6% of engineering graduates are Black (Royal Academy of Engineering, 2022).

- Only 2% of UK professors in STEM are Black (Advance HE, 2023).

Systemic barriers, such as underfunded schools and racial bias in hiring, contribute to these disparities (McGee, 2020).

| Black Students | Hispanic/Latinx Students | Indigenous Students |
|---|---|---|
| Earn 7% of bachelor's degrees in STEM despite comprising 13% of the population (NSF, 2023). | Earn 12% of STEM degrees but are 19% of the population (NSF, 2023) | Represent <1% of STEM graduates (NASEM, 2021) |

# Underrepresented Groups in STEM Education

- **Socio-economic Backgrounds to STEM Education:**

- Students from low-income backgrounds often lack access to advanced STEM courses, extracurricular programs, and mentorship.

- Financial constraints also limit college attendance and persistence in STEM majors (Tyson et al., 2007).

# Underrepresented Groups in STEM Education

▪ **Non-binary Gender Representation in STEM Education:**

• Non-binary individuals in STEM face discrimination and exclusion, leading to lower retention rates (Cech & Waidzunas, 2021).

• A 2018 study found that they were more likely to leave STEM fields due to workplace hostility (Hughes, 2018).
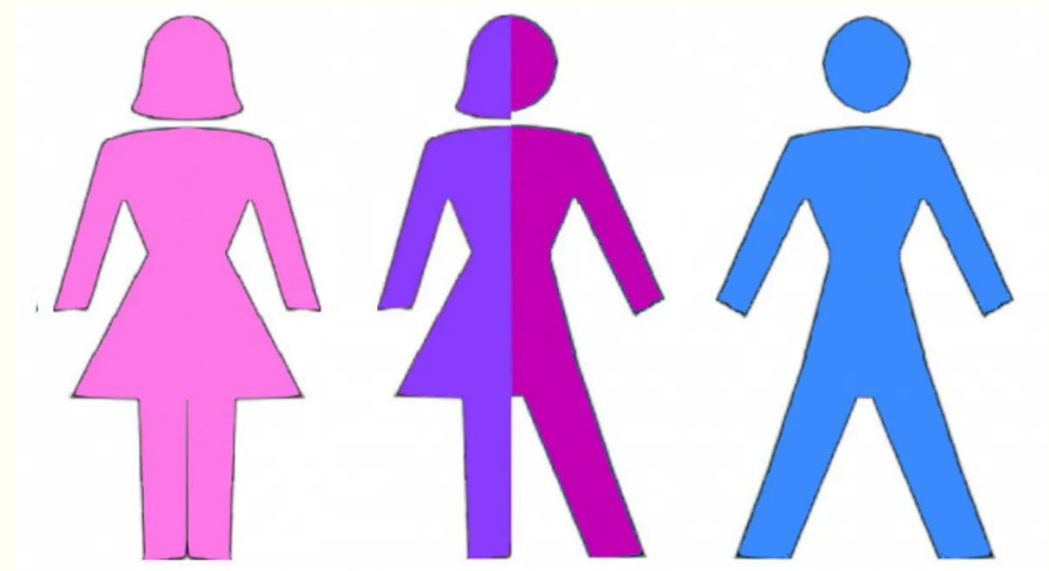
# Underrepresented Groups in STEM Education



- **People with Disabilities in STEM:**

- Individuals with disabilities are underrepresented in STEM due to physical barriers, lack of accommodations, and societal biases (Dunn et al., 2020).

# Barriers to Diversity in STEM

- **Systemic Inequalities in Education and Hiring**

Underfunded educational institutions or schools in minority communities often lack advanced STEM courses (Oakes, 2005). Hiring biases also persist, with studies showing that resumes with disadvantaged groups receive fewer callbacks (Bertrand & Mullainathan, 2004).

- **Lack of Role Models and Mentorship**

The absence of diverse role models discourages underrepresented students from pursuing STEM careers (Lockwood & Kunda, 1997). Mentorship programs, such as those by the achievers help address this issue.

- **Implicit Bias and Discrimination in STEM Workplaces**

Implicit bias affects hiring, promotions, and workplace culture (Moss-Racusin et al., 2012). Women and minorities often report experiencing microaggressions and exclusion in STEM environments (Ong et al., 2011).

# Strategies to Promote Diversity



- **Outreach Programs and Scholarships for Underrepresented Groups**

Programs and Scholarship Funds for underrepresented groups provide financial support and early exposure to STEM (Scott et al., 2018).

- **Inclusive Hiring Practices and Workplace Policies**

Blind recruitment, diversity training, and equitable promotion policies can reduce bias (Kang et al., 2016). Companies like Intel have implemented diversity quotas with measurable success.

- **Mentorship and Networking Opportunities**

Mentorship improves retention among underrepresented groups (Blake-Beard et al., 2011). Such initiatives facilitate networking.

# Institutions Improving Diversity

- **Georgia Tech's College of Computing**: Increased female enrollment from 12% to nearly 30% through targeted outreach (NSF, 2021).

- **IBM's Neurodiversity Program:** Hires individuals with autism for tech roles, demonstrating inclusive hiring success (Austin & Pisano, 2017).

# Diverse STEM Leaders

▪ Dr. Mae Jemison

First Black woman astronaut, advocate for STEM diversity.



▪ Dr. Temple Grandin

Renowned autistic scientist who revolutionized animal science

# Gender Disparity in STEM

- Despite significant advancements in gender equality over the past century, women and non-binary individuals remain underrepresented in Science, Technology, Engineering, and Mathematics (STEM) fields.

- While some disciplines, such as biology, have seen increased female participation, others like engineering and computer science remain heavily male-dominated.

# Women and Non-Binary Individuals in STEM Fields

- Globally, women constitute only 28% of STEM researchers (UNESCO, 2021).

- In the U.S., women earn 42% of STEM bachelor's degrees but hold just 27% of STEM jobs (NSF, 2023).

- Non-binary individuals face even greater underrepresentation, with limited data due to insufficient tracking (Cech & Waidzunas, 2021).

# Variations Across Different STEM Disciplines

**Biology & Life Sciences**

Women earn 60% of undergraduate degrees (NSF, 2023).

**Engineering**

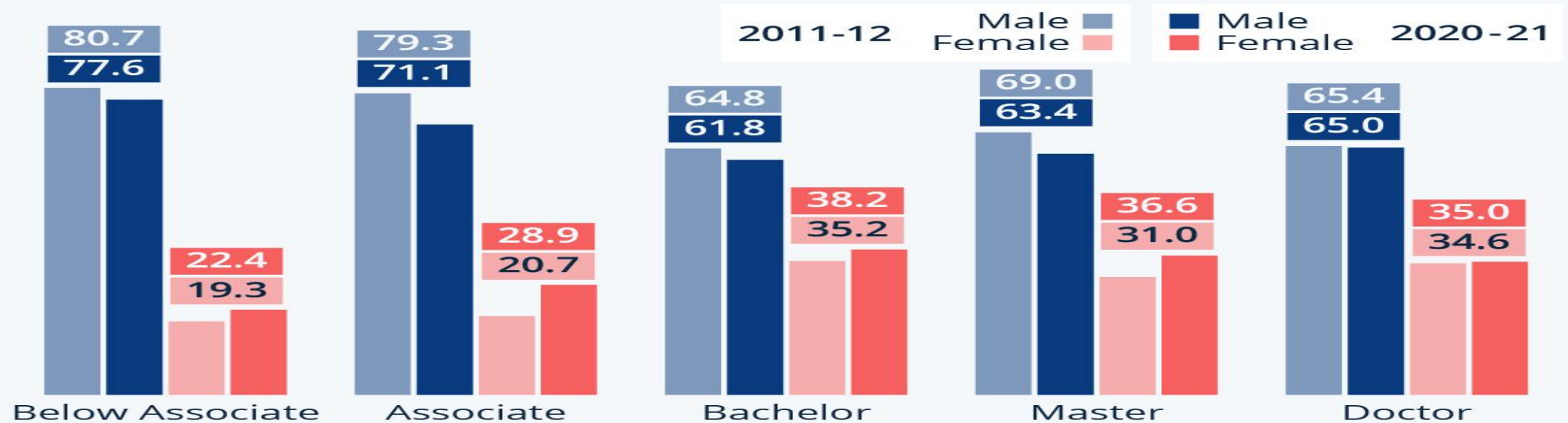Only 22% of degrees are awarded to women (AAUW, 2022).

**Computer Science**

Female participation peaked in the 1980s (~37%) but declined to 18% by 2020 (Google & Gallup, 2020).on

# STEM College Degrees Still Male-Dominated

Share of male/female students in conferred STEM* degrees of U.S. postsecondary institutions, by academic year (in %)

**2011-12**   Male   Female    Male   Female   **2020-21**

| | Below Associate | Associate | Bachelor | Master | Doctor |
|---|---|---|---|---|---|
| Male 2011-12 | 80.7 | 79.3 | 64.8 | 69.0 | 65.4 |
| Male 2020-21 | 77.6 | 71.1 | 61.8 | 63.4 | 65.0 |
| Female 2020-21 | 22.4 | 28.9 | 38.2 | 36.6 | 35.0 |
| Female 2011-12 | 19.3 | 20.7 | 35.2 | 31.0 | 34.6 |

\* Science, technology, engineering, mathematics
Source: National Center for Education Statistics

**statista**
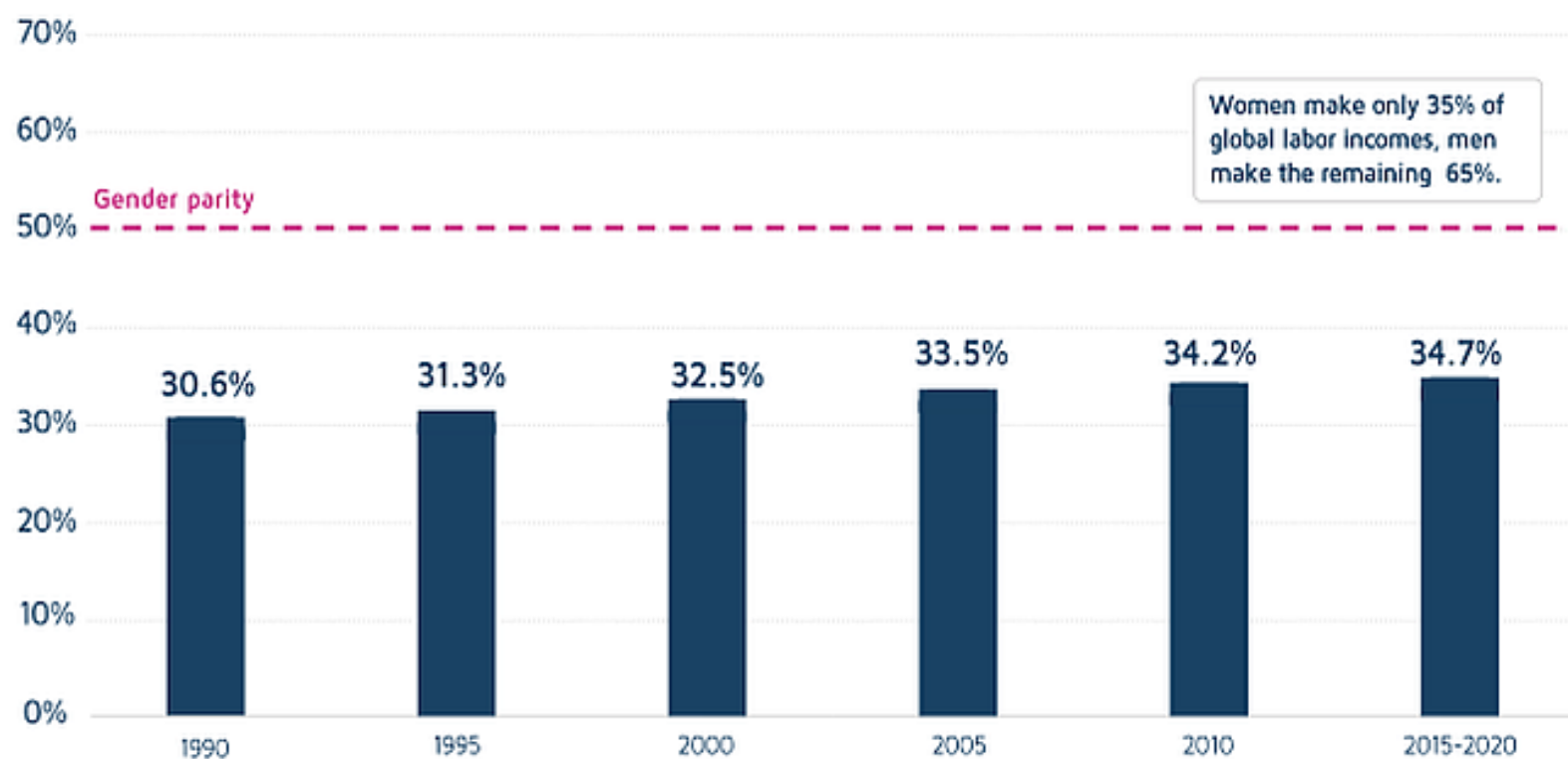
Source: *World Inequality Report 2022*

# Disparities by region

Arab States: 37% of STEM graduates are women.

Sub-Saharan Africa: 30% of STEM graduates are women.

Central & Eastern Europe: 41% of STEM graduates are women.

(UNESCO, 2021)

# Root Causes of Gender Disparity



- **Societal Stereotypes and Gender Roles**

From childhood, girls are often steered away from STEM due to stereotypes that associate science with masculinity (Bian et al., 2017). Surrounding even the toys marketed to boys (e.g., robotics kits) reinforce these biases, while girls are encouraged toward caregiving roles (Cheryan et al., 2017).

# Root Causes of Gender Disparity



- **Lack of Early Encouragement for Girls in STEM**

Girls receive less encouragement from teachers and parents in math and science (Gunderson et al., 2012). By middle school, 50% of girls lose interest in STEM due to societal pressures (Microsoft, 2017).

- **Workplace Challenges**

- Pay Gap: Women in STEM earn $15,000 less annually than men.

- Harassment: 40% of women in tech report gender discrimination.

- Glass Ceiling: Only 21% of engineering executives are women (Catalyst, 2023).

# Impact of Gender Disparity



- **Effects on Innovation and Problem-Solving**

Diverse teams produce 35% more patents than homogeneous ones (Hunt et al., 2018). A lack of female perspectives in AI development has led to biased algorithms (Buolamwini & Gebru, 2018).

- **Economic Consequences**

- For Women: The gender pay gap costs women in STEM $1.2 million over a lifetime (AAUW, 2022).

- For Industry: Gender-diverse companies are 21% more profitable (McKinsey, 2020).

# Efforts to Bridge the Gender Gap

- STEM Education Initiatives for Girls

- Policies Promoting Gender Equality

- Role of Male Allies

- Prominent Women in STEM

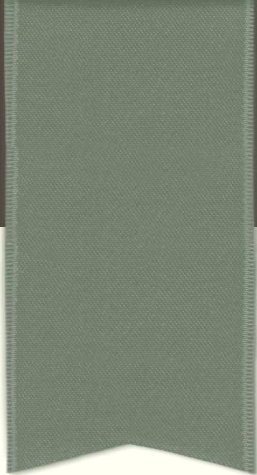- Organizational Initiatives and Culture for Closing the Gap

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