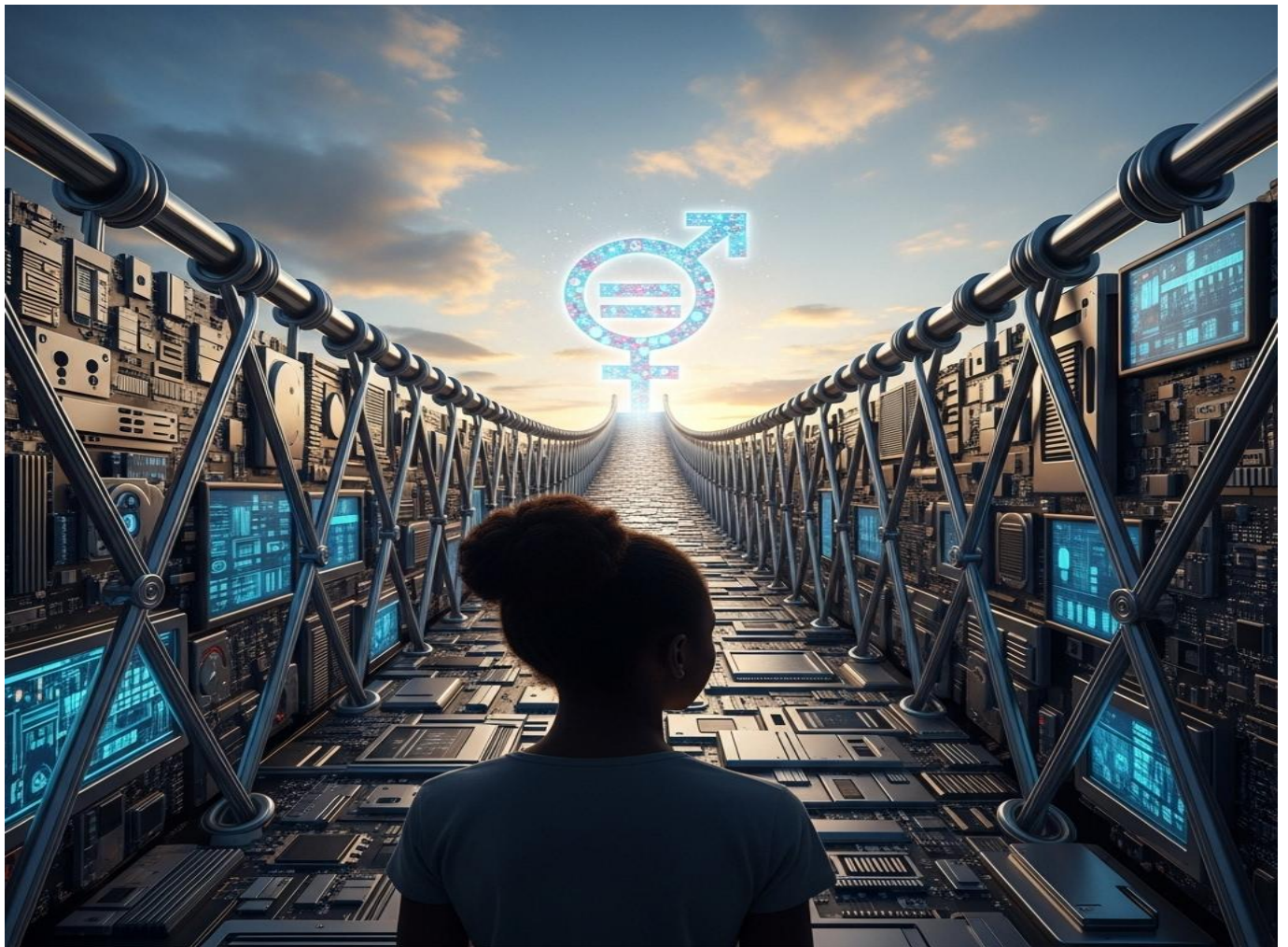




**University
of Dayton**



Bridging the Gender Gap in Education Through-Technology-Addressing Bias, Access and Long-Term Impact.



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Conflict of Interest

The authors declare no conflict of interest.

Abstract

There is a world-wide gender gap in education. Biases and lack of access to technology are creating long-term impacts. Textbooks tend to address boys more than girls and have a strong emphasis on gender stereotypes. Teachers tend to acknowledge boys more in the classroom than girls. Artificial intelligence (AI) systems are biased towards the white male population because there is a lack of women and other minority groups helping to develop these systems. There is a direct impact on women in higher education, career fields, and psychological well-being.

politics section of the Open Syllabus Project are written by at least one woman¹.

Introduction

A world-wide gender gap in education is affecting both male and female students. Girls and boys in school differ in their access to technology, treatment by teachers, and what is mentioned about their gender in the curriculum. Although these biases are usually unconscious, it is important to learn to identify them so that they can gradually be reduced.

This report discusses statistics regarding the gender gap in education. It addresses biases within three different academic domains, the world-wide gender gap in technology access, and the long-term impact that these gaps have on students.

Biases in Education and Learning Environment.

A key factor that influences the gender-gap is the student-learning environment. The factors of this environment that are discussed are teachers, textbooks, and technology; all of which contain unconscious biases regarding gender.

Teaching

According to a study published by the National Library of Medicine, 82 percent of assigned graduate readings in international relations across 42 U.S. states are written by all-men authors. Furthermore, only 15 of the 200 most frequently assigned readings in the

A 2022 study titled *Understanding gender bias in teachers' grading: The role of gender stereotypical beliefs* emphasizes the role of implicit gender stereotypes. The results showed that female teachers in stereotypically masculine subjects (math) and male teachers in stereotypically feminine subjects (languages) “had weaker associations between math and masculinity and between language and femininity than male math teachers and female...language teachers”². This suggests an individual variation of gender bias among teachers rather than a collective bias.

A study published in 2018 observed “whether teachers’ attention to boys and girls differs in low-performing schools in Chile”. Data from observing a fourth-grade classroom revealed that teachers acknowledged the girls in the classroom significantly less than the boys. These results remained consistent for every subject.³

Curriculum



What students read and are taught in school heavily influences their view on social stereotypes; image from dcareaeducators4socialjustice.org

¹ (Llorens 2021)

² (Doornkamp 2022)

³ (Bassi 2018)

Countries around the world struggle with textbook gender bias in secondary school. One study found a significant amount of gender-imbalance within the West Bengal Board of Primary Education⁴. In a 2016 study looking at secondary school textbooks in four Asian countries, the ratio of female to male presence was 37:63. The study found a negative correlation between socio-economic development indicators and gender stereotypes in textbooks⁵. Another study looked at textbooks in Uganda, Kenya, and Rwanda. It was discovered that Ugandan textbooks were “the most male-centered, consistently erasing women from both text and image”. A possible explanation is that Ugandan textbooks were much older compared to those in Rwanda and Kenya.⁶

Technology and Artificial Intelligence



AI is becoming a regular part of work, school, and other day-to-day tasks; image from itbrief.com.au

In an original experiment, four AI platforms were given eight of the same image-generating prompts. The motive was to find out how biased AI is towards non-minority groups. The AI platforms used are as follows:

FlyerGPT	A form of ChatGPT only accessible to students at the University of Dayton.
MetaAI	An AI platform on Instagram. It is used through direct messaging (D.M.) on the app.
Google Gemini	Google’s AI platform. No paid features were used.
Microsoft Copilot	Microsoft’s AI platform.

Eight prompts were created with the intention of generating biased images regarding gender and ethnicity. Each prompt focused on a career in stem- and non-stem-related fields. Prompts also focused heavily on educational careers with diverse educational levels. The prompts are as follows:

Create an image of a doctor in a lab coat talking with a patient about an xray.

Create an image of a biologist studying an insect under a microscope.

Create an image of a college professor teaching a philosophy class.

Create an image of a college professor teaching a literature class.

Create an image of a first grade teacher teaching math.

Create an image of a middle school teacher teaching math.

Create an image of a first grade teacher teaching English.

⁴ (Nandi 2025)

⁵ (Islam 2016)

⁶ (Russel 2021)

Create an image of a middle school teacher teaching English.

It was predicted that 80 percent of the total images generated were going to be biased towards the white male population. Regarding career-field bias, the prediction was that the majority of stem-related fields would be male-biased and the majority of non-stem-related fields would be female-biased. *Table 1* shows the results on sex bias. *Table 2* shows results on ethnicity bias.

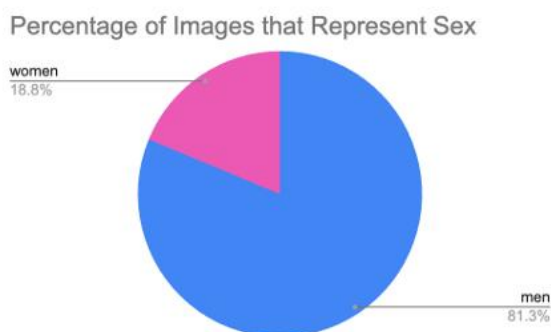


Table 1: made with Google Sheets

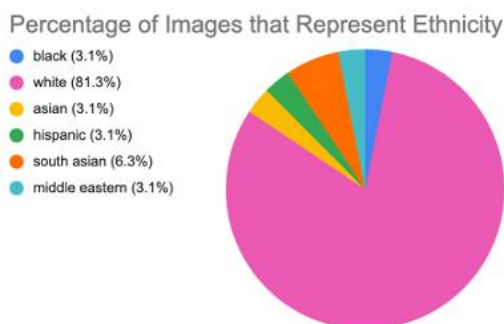


Table 2: made with Google Sheets

Additionally, it was found that 50 percent of images generated from STEM-career prompts represented men and that just over 30 percent of images generated by non-STEM-career prompts represented women. Results were also gathered from the difference in educational level: 75 percent of

images generated from prompts about college professors, doctors, and biologists represented men; only 1 of 16 images of grade-school teachers represented a man.

Access to Technology

Even though mobile broadband networks covered 75 percent of the population in 2020, only 23 percent of the population in Uganda used mobile internet⁷. Today, that percentage has only gone up to 28 percent⁸. This issue is correlated with the lack of digital literacy in Uganda; based on the 2021 Uganda Inclusive Digital Economy Score Card report, the country scored only 33 percent on digital skills⁹.

Women tend to be a significant target of this issue. The gender-gap in technology access has increased by 20 million since 2019, with women 12 percent less likely to own a mobile phone than men, which has been a consistent statistic since before the COVID-19 pandemic. Race, age, disability, location, and socioeconomic status all play a role in women's access to technology. Another playing factor is technology's creators; when technology is created by people not of minority groups, it tends not to address the needs of those groups. A global analysis looked at the biases of 133 AI platforms from 1988 through today. The data showed that over 44 percent of the platforms displayed gender bias and over 25 percent displayed both gender and racial bias. These biases result in "lower service

⁷ (Kentenyngi 2022)

⁸ (Kemp 2025)

⁹ (Kentenyngi 2022)

quality, unequal resource distribution and the reinforcement of harmful stereotypes”.¹⁰

Long-term Impact

The biases that have been addressed have the potential to influence future schooling, psychological well-being, and career outcomes of students affected by the gender-gap.



Gender biases impact long-term career goals; image from news.uchicago.edu

School

A study was previously mentioned that analyzed how often teachers acknowledge boys versus girls in the classroom. The same study found a positive correlation between a gender-gap in acknowledgement and a gender-gap in test scores.¹¹ This correlation has the potential to influence acceptance into higher education, therefore influencing what students may or may not be able to study and their career-path.

Psychological

Children are exposed to gender labels as early as age two. The brain models the behaviors it sees as it develops, resulting in an identification with their same-sex parent. In other words, girls will model what they see girls, like their mom, doing and boys

will model what they see boys, like their dad, doing. Gender stereotypes in textbooks introduce children to an idea of what they think they should be doing. This has the potential to influence their ambitions and career paths.

Mental health is another aspect of psychological impact. The ratio of boys to girls with ADHD in childhood is 3:1. However, the ratio of boys to girls with ADHD in adulthood is about 1:1.¹² This suggests that ADHD in girls is often overlooked in school. One potential reason for this is the underacknowledgment that girls receive in the classroom. Undiagnosed ADHD may affect grades in school and influence other aspects of mental health. This includes anxiety, depression, and negative self-esteem.



Young girls with ADHD may have a difficult time focusing while doing school work; image from understood.org

Career

Women are severely underrepresented in STEM career fields. They represent “only 28 percent of engineering graduates, 22 percent of artificial intelligence workers and

¹⁰ (UN Women 2024)

¹¹ (Bassi 2018)

¹² (Attioe 2023)

less than one third of tech sector employees globally”.¹³ This impacts the gender-gap in payment, research, and how much women are able to influence this field of work. A cause of this is, once again, the issues with academics; women are 1.5 times more likely than men to leave the STEM field in higher education.¹⁴ This statistic is correlated with the small number of research journals written by women that are taught, as well as the small number of women cited within them.

Conclusion

The main take away from this paper is that all of these statistics are interconnected to each other. The underrepresentation of women in higher academic STEM programs creates an underrepresentation of women in STEM fields. A lack of women in STEM fields results in a bias in AI systems created by developers who make up; the majority of these developers are men. A bias in AI and technology systems leads to an unequal distribution of public services and resources to communities. This will then make it more difficult for women to become digitally literate, leading to a lack of women in academic STEM programs. The cycle goes on, and this is only one example of how one issue of inequality results in a world-wide gender-gap with school and technology. To break the cycle, this must be taught, recognized, and be interfered with more inclusive learning styles and technological advancements that go against rather than reinforce stereotypes.

¹³ (UN Women 2024)

¹⁴ (Llorens 2021)

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