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Gender Issues in Science and Technology

Rupinder Preet Kaur*

Abstract

The issue of gender bias in science and technology was extensively raised for a long time and as a result, the entry of women in science and technology got started. However, the participation of women in science is still not in parity of expectation. This issue can be addressed by thorough monitoring, informing, and creating the required working circumstances for women.

Keywords: Engineering and mathematics, Gender inequality, Science and technology, Technology, Women in science

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Introduction

We have been addressing gender inequality globally for centuries. Women and society cannot afford another century of discussion. We must put an expiration date on discrimination against women and the epidemic of gender-based violence. Yet, if one looks at the statistics, we are not poised to realize gender equality in the near future. Consider girls' education: most have agreed that everyone deserves an equal education but it will take over 80 years before there is parity for girls in secondary education. According to report released by the National Academies of Sciences, Engineering, and Medicine, in 2018, 20–50% of women worldwide have experienced either physical and/or sexual violence.[1]

Science and technology will increasingly play a profound role in our lives, societies, and economies - from influencing social interaction and culture to voice and political participation, to access to services, learning, and income opportunities, to innovation, infrastructure development, resilience and sustainability, to the achievement of personal well-being. These all require urgent action based on the best available science, technology, and interdisciplinary research - including the perspectives, talents and experiences of women as well as men.

Science and especially, technology, has been considered "masculine" for a long time and gender gap in science has been observed in most societies.[2] When women and girls have equal access to and control of technology, the potential benefits are vast. However, this scenario is not automatic. The revolutions in science and technology are not fully inclusive in their participants, design and impact. Moreover, we must be diligent in preventing and mitigating risks to women when it comes to science and technology, either in the form of direct threats - including online violence and harassment–unintended consequences, or from reinforcing or exacerbating inequalities. We see tremendous ways in which women are creating, directing, and using science and technology, but we want these to be the rules, not the exceptions.

Girls and women remain substantially under-represented in mathematics, science, and technology in school and in the workplace. In recent years, the number of women involved in science has significantly increased. However, although there are encouraging signs, women are still under-represented in science. Today women account for only 30% of the world's researchers, and even lower percentages at higher decision-making levels. This is often due to barriers such as inappropriate school environments for girls, safety concerns, teaching methods that favour boys, and varying levels of access to technical and vocational education. Some of these problems can be addressed by promoting gender-relevant teaching methods and materials and providing funds to promote girls and women in S and T education. In addition, there is a decreasing representation of women in science, technology, and innovation (STI) from secondary school to university, laboratories, and then management, known as the "leaky pipeline",[3,4] due to gender bias in S and T subjects, domestic and career responsibilities and inflexible working hours. To increase the participation of women in science, it would be necessary to promote women role models in STI, allow flexible working conditions, and support women's recruitment, retention, advancement and leadership in this area.

In India, despite the increasing number of women in higher education in science, women's participation at higher levels of science in tenured research positions has shown little increase. Women constitute over one-third of the total science graduate and post-graduate degree holders, but comprise only 15–20% of the tenured faculty across research institutions and universities in India, (INSA Report, 2004). Science careers begin at the early stage soon after PhD and it is important for women to establish themselves during their early 30s. However, this period coincides for most Indian women with marriage and family commitments. Breaks or temporary research positions of 3–5 years during this period do not provide the advantage of moving up the ladder at a later stage when family commitments take less time. Thus, as a compromise, a large number of qualified women scientists opt for undergraduate or school level teaching assignments, while others completely drop out of science.[5]

A study by Society for Socio-Economic Studies and Services, Kolkata (Table 1) indicates that female presence is around 20% considering scientific and administrative staff other than Post-doctoral fellows. Among Post-doctoral candidates <29% are female. The figure is higher among Ph.D. students with more than 33% being female.[6]

Department of Chemistry, Guru Nanak Dev University College College Verka, Amritsar, Punjab, India

Corresponding Author:
Dr. Rupinder preet Kaur, Department of Chemistry, Guru Nanak Dev University College College Verka, Amritsar, Punjab, India.
E-mail: rupinder_chemverka@gndu.ac.in

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Table 1: Presence of Women in Science in Surveyed Institutes

Category of Woman in Science	*Female (%)*
Working (Scientific and Administrative Staff)	20.0
Post-Doctoral Fellows	28.7
Ph.D.	33.5
Students (UG and PG)	24.0

Having more women in science is not only about gender equality and equity but is also in the larger interest of scientific progress and society. Studies indicate that male domination of research can lead to gender differences being overlooked, making research output male-centric. For example, there is not much data on female crash dummies, even though the anatomies of men and women are different. Another example is that of aspirin which was developed in 1899, but it was only in 1993 that its differing effects on men and women were discovered. Loss of educated women in the science workforce is a loss of national and private resources spent on their education. It is an opportunity loss in terms of their possible contributions to science and society.

The outbreak of the coronavirus disease 2019 (COVID-19) pandemic has clearly demonstrated the critical role of women researchers in different stages of the fight against COVID-19, from advancing the knowledge on the virus to developing techniques for testing, and finally to creating the vaccine against the virus. During COVID-19 pandemic, women who represent 70% of all healthcare workers, have been among those most affected by the pandemic and those leading the response to it. The COVID-19 pandemic also had a significant negative impact on women scientists, particularly affecting those at the early stages of their career, and thus contributing to widening the existing gender gap in science, and revealing the gender disparities in the scientific system, which need to be addressed by new policies, initiatives and mechanisms to support women and girls in science. Yet, as women bear the brunt of school closures and working from home, gender inequalities have increased dramatically over the past year.

Methods to Minimize Gender GAP

The problem needs to be addressed at two levels - mindset issues at the individual level and the policy and institutional level changes. The former may be more difficult to address and would require sustained efforts over a longer period of time, but the policy and institutional level changes can be brought about more quickly. The scientific community should work towards addressing both the aspects of the issue. To promote and retain women in science, the following measures may help to prevent permanent loss of skilled scientific woman power and going a step further ascertain continuity in higher studies or career in science among women.[1,6,7]

- A conceivable strategy to improve the pace of transition from doctoral to post-doctoral research is to increase the number of post-doctoral fellowships available and ensure that they are available on a consistent basis. As an added incentive, special monetary and nonmonetary awards tied to the successful and timely completion of projects may be introduced
- Interventions aimed at popularising disciplines like engineering, physical sciences, and chemistry among female students in both urban and rural areas could be beneficial in changing attitudes. Awareness programmes that expose children and their parents to the work and lives of accomplished female physicists and scientists may help to pave the way for improvement by attracting a critical mass of students to these less popular subjects
- Schools and universities might organize programmes by arranging for science professionals to visit and share their perspectives not only with aspiring candidates but also with their parents in a seminar or workshop format. Visits to science laboratories and institutes are also possible (similar to study tours for social sciences or industry visits in management programmes). This could also be accomplished through the use of mass media and social networking sites
- Women scientists who are already established should visit research institutes, universities, and colleges on a regular basis to encourage female students and scholars (who are already in the pipeline) to pursue higher education in science in these less popular subjects
- Interventions aimed at introducing more flexibility in registration, readmission to higher studies, and research will make resuming education easier and more seamless. To avoid losing potential talent, educational breaks must be accommodated. This will also give you more room to play multiple roles
- It is desirable to introduce flexibility into service continuity norms. Because women scientists have dual commitments, career pauses must be accommodated. Seniority based on total years of work experience or service rather than "continuous" service may aid in the retention of talent and experience by allowing for the re-entry of women scientists who would otherwise be lost forever
- Flexibility in employment contracts that allow for time commitment flexibility may be beneficial. Fixed-term and split (part-time) contracts could be made to be as appealing as full-time or permanent positions
- The existing easing of eligibility standards for women in terms of age limit may be replaced with an assessment of eligibility based on experience or other performance indicators
- A policy intervention promoting research support services will aid in the better integration of women who have had a career hiatus and are considering re-entering the workforce
- Expanding institutional non-academic infrastructures, such as housing, transportation, family care, and health-care-related support services, can help to alleviate the dual role difficulty that women experience in science while simultaneously addressing safety and security concerns. To be more effective, childcare facilities at work should be expanded to include children up to the age of fourteen.

Conclusion

In today's society, women play a vital role in a variety of areas. They contribute significantly to the advancement and betterment of life in a variety of areas. Unfortunately, science and technology are fields in which women and men do not have equal opportunities. There are many probable explanations for this disparity, but gender bios, biases, and unequal resource allocation are among the most common. In STI, gender disparity is more prevalent in poor nations. There are several approaches to deal with the issue. The situation in this field should be improved by thorough monitoring, informing, and creating the required working circumstances. Gender equality and normal working circumstances for both men and women are features of any normal society, and it is critical to pay attention to the problem of gender imbalance in science and technology because it can benefit the development of these fields.

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