

Participation of Women in Science and Technology: Unfolding Challenges

Dr. Anuradha Sekhri

Research Associate, Institute for Development and Communication (IDC), Sec 38-A, Chandigarh (India)

ARTICLE DETAILS

Article History

Published Online: 10 January 2019

Keywords

Women, Science, Education, Career

Email: [anu.sek2010\[at\]gmail.com](mailto:anu.sek2010[at]gmail.com)

ABSTRACT

Traditionally, women in India have stumble away from engineering and related fields. In the context of women scientists and professionals in India, the need of the hour is the creation of structures that can facilitate negotiation of a career in science in a professional manner while maintaining a career-family balance. With evolving policies and institutional efforts to promote women scientists in India, significant change has been observed over the years with regard to women's access to science education and careers. As per Global Gender Gap 2017 report, for educational attainment we fare slightly better at 112, having closed the gap in enrollment in primary and secondary education across most states in India. Further, India is slowly closing the gap in tertiary (higher) education. Gender stereotypes manifest in a variety of ways in a workplace. Globally, in the workplaces, women scientists have been known to meet with challenges that affect their performance and progress in the field of Science and Technology. Many factors continue to affect the development of a woman's career in Science and Technology. Girl's underrepresentation in these fields is due to Cultural norms and societal roles including restrictions in choosing these fields, thus compromising their professional growth. The visibility of women as students and teachers are greater in number but their participation in decision making process is very low. This paper analyses the factors and perception of females that influence participation of women in science and technology.

1. Introduction

Women have long been fighting to be recognized in the same light as men. Although the past few decades have seen fundamental growth in gender equality, the reality is that equal opportunity is still a challenge for women in certain disciplines in various countries. India, for one, is making slow progress in regard to advancing women in science. This is evident in country reports conducted last year (Huyer & Halfkin, 2013). Although there has been increase in number of women aspirants in research, but the percentage of women scientists the top position is very low. The visibility of women as students and teachers are greater in number but their participation in decision making process is very low.

Even in the countries where equality in education is achieved, equality in employment is quite distant. All over the world, women scientists are more likely to be employed in non-regular positions than regular positions, paid less, promoted less, and win fewer grants compared to their male counterpart.. The percentage of women in decision making positions is much less than that of all employees. Few women are in leadership positions in universities, research institutes, government, and governing or advisory bodies.

Even in the Philippines where women's participation in the S&T fields is larger than males, there are far fewer women in the leadership positions. Women's careers are often interrupted due to family reasons. Women are reluctant to apply for promotion and this contributes to a salary gap, whereby women are paid less for doing the same jobs as men. One recent study by Graduate Careers Australia found that male graduates earn 9.4% more than females with the same qualifications. The salary gap is closely related to the

promotion gap in Australian universities and research organizations.

As per Global Gender Gap 2017 report, for educational attainment we fare slightly better at 112, having closed the gap in enrolment in primary and secondary education across most states in India. Further, as a country, India is slowly closing the gap in tertiary (higher) education. India (108) experiences a decline in its overall Global Gender Gap Index ranking, largely attributable to a widening of its gender gaps in Political Empowerment as well as in healthy life expectancy and basic literacy. In addition, newly available data reveals the scale of India's gender gap in women's share among legislators, senior officials and managers, as well as professional and technical workers for the first time in recent years, highlighting that continued efforts will be needed to achieve parity in Economic Opportunity and Participation. More positively, India succeeds in fully closing its primary and secondary education enrolment gender gaps for the second year running, and, for the first time has nearly closed its tertiary education gender gap. However, it continues to rank fourth-lowest in the world on Health and Survival, remaining the world's least-improved country on this sub index over the past decade. Finally, with more than 50 years having passed since the inauguration of the nation's first female prime minister in 1966, maintaining its global top 20 ranking on the Political Empowerment sub index will require India to make progress on this dimension with a new generation of female political leadership. According to Jerrim and Schoon (2014), although women have outnumbered men in tertiary education within developed countries, they are still under-represented in certain disciplines like physical science, technology, engineering and mathematics. Similar to the trends observed in developed countries, fewer women in India take up professional careers within these fields.

In India, the real attrition begins after the Ph.D. The fraction of women with successful careers in science and those who achieve top positions in research and/or administration is very small, independent of discipline. Out of the 25-30% Ph. D.'s, the proportion in faculty is between 15 and 20% and at higher levels the number further drops. The numbers are even lower with an increase in the reputation (as publicly perceived) of the Institution. Women heads of laboratories, science departments of the government, or as members of governing or advisory bodies are rare. The perceived reason for the steady decrease in numbers is the inability of women to balance a family and career, the inherent assumption being that the family is solely the responsibility of the woman. For more than a decade, the Government of India has announced "gender equity in Science and Technology (S&T) " to be the goal of its S&T policy. A number of programs to provide ways for women to come back to science after a break have been introduced by different arms of the government as well as the private sector (Godbole & Ramaswamy, 2015).

In the context of women scientists and women science professionals in India, the need of the hour is the creation of structures that can facilitate negotiation of a career in science in a professional manner while maintaining a career-family balance. With evolving policies and institutional efforts to promote women scientists in India, significant change has been observed over the years with regard to women's access to science education and careers.

2. Review of Related Literature

The investigation of gender differences has been a significant area of study for many researchers in science (Scanlon, 2000). Despite this connection, there is sometimes disconnect between students' enjoyment of science and their desire to pursue science-related careers (Silver & Rushton, 2008). Gaps that exist between male and female students in terms of interest, experience, achievement and career interest in science (Hamrich, Richardson & Livingston, 2000).

Among high-school students, girls are significantly less likely to take a computer programming class than boys (Schumacher & Morahan-Martin, 2001) and express less interest in pursuing careers in computer science and engineering than boys (Weisgram & Bigler, 2006). Gibson and Chase (2002) found students maintained a more positive attitude towards science and a higher interest in science careers. Hasni and Potvin (2015) found methods centered on inquiry process promote the development of students' interest in science and technology. Cheryan, Master and Meltzoff (2015) argued girls' underrepresentation in these fields is not due to their intractable lack of interest in choosing these fields, instead they argued that women's choices are constrained by societal factors.

Achieving gender inclusiveness in science has been a concern to educators, academia and scientists across the world, who questions the masculine culture of engaging in science and call for conscious and affirmative gender action (Schreuders et al., 2009; Etkowitz et al., 1994). The 'pipeline theory' as a dominant framework explains that the gender

disparity in science and engineering originates from the fact that very few women opt for science and mathematics prior to starting college (Schreuders et al., 2009; Didion, 1995; American Association of University Women (AAUW), 2010 cited in Grossman & Porche, 2014). Moreover, women experience leakage points at various stages of their career right from school education to work. The leakage points can be at the institutional level or at the societal level. Regarding the question related to facing barriers in science, respondents narrate that they have not faced many institutional barriers while pursuing their science studies in the past as compared to the socio-cultural challenges which influence the decision-making of women for prioritizing family over the career goals. The social system comprising of family, peer, community and kinship groups shape and influence adolescents' decision-making in science engagement (Grossman & Porche, 2014)

3. Objective of the study

To study perception of women regarding science and technology related careers and barriers in the participation of women in S&T field.

4. Methodology of the Study

In-depth interviews were conducted regarding obstacles they have experienced while choosing the career. An interview schedule was prepared and 20 in-depth interviews were conducted. Purposive and random sampling was used for selecting the sample of the study. The study was conducted in Panjab University. The sample consisted of 20 women are pursuing their career in science and technology in Panjab University, Chandigarh of different disciplines.

5. Analysis of Interviews

The women in the sample have very different career paths and development. They are pursuing the field of science and technology of different disciplines. The responses were analyzed by conducting in-depth interviews with women from diverse fields who choose these carriers.

To the Question regarding being successful in career, most of the women are worried about the future in this field. They were not much confident regarding the success achieved till now. Another question addressed was regarding difficulties faced by women to achieve success in this field. Majority of the women felt that gender stereotypes manifest in a variety of ways in a work environment. For women it is much more difficult due to a patriarchal culture that considers the woman responsible for taking care of the family. It is crucial to change these socio-cultural attitudes, and break down gender bias and stereotypes in families and the workplace.

To the question regarding their future goals and aspirations, most of the women expressed their interest of joining post doctoral and research field of science. Only few of them were interested in teaching field.

To the question regarding gender gap in science and technology disciplines, they all agreed that gender gap is slowing closing in these disciplines. But sometimes due to lack of opportunities at workplace women are not hired at same rate

as men. All the women were of opinion that number of women in decision making process is still few in India. Women's careers are often interrupted due to family reasons. When asked about the reasons, they were of opinion that this may be due to social pressure for women to accept the responsibility for caring for the home and family. All the interviews pointed one fact that due to lack of exposure. The barriers to participation to women in the field of science and technology are slow to breakdown not because of their ability to work in these fields, but because of entrenched attitude of society towards girls working in science and technology field. All of the women raised their opinion regarding lack of exposure and awareness of opportunities in these fields. Respondents reveal that there is need to enhance their self-confidence and their capability to increase participation of more and more women in the field of science and technology. Many of them are also applying for further research projects with other funding agencies.

Following suggestions were made by respondents to change the perception of women towards career in science and technology:

6. Recommendations for educators

- 1) Provide equal opportunities in science education for girls and encourage girls at the grade school level.
- 2) Prevent gender bias by educating parents about gender stereotypes.
- 3) Educate the public, parents and students that girls do equally well in mathematics and science.
- 4) Increase public awareness of science through programs such as Science Fairs.
- 5) Encourage women to pursue their jobs after completing their Ph.D. degree.

7. Recommendations for policy makers

1. Establish policies and procedures for ensuring equality in hiring & promotion.
2. Create measures to increase the percentage of women in research and academic positions, and the number of women in leadership positions in S&T.
3. Evaluate government programs in science and technology through a gender lens.
4. Collect and analyze the data necessary to design policy initiatives effective in meeting academic and professional needs of women researchers.
5. Establish funding mechanisms for the women after they complete higher level degrees.
6. Establish funding for programs in academic organizations to support and foster women scientists.
7. Establish job-oriented technology education program for women.
8. Increase awareness that gender bias in the mindset of male leaders has great impact on cultivating women leadership.
9. Develop country specific outreach programs for female students, teachers, and science professionals.
10. Encourage flexible work schedules.

8. Conclusions

Although women have outnumbered men in tertiary education within developed countries, they are still under-represented in certain disciplines. The results of present study indicate that girls' underrepresentation is not due to an intractable, immutable lack of interest or ability. Instead, girls' choices are driven, to a large degree, by socio-cultural factors—for example, stereotypes about who typically does STEM and who has ability in STEM. Women's careers are often interrupted due to family reasons. Several factors were revealed by the women that creates hindrance in participation of women in science and technology. In order to avoid the exit of women prematurely, there is need to increase self confidence, more exposure, more career opportunities for women and flexible working hours.

References

1. Cheryan, S., Master, A., & Meltzoff, A. N. (2015). Cultural stereotypes as gatekeepers: Increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology*, 6, 49.
2. Godbole, R. M., & Ramaswamy, R. (2015). *Women Scientists in India. In report on Women in Science and Technology in Asia*, The Association of Academies and Societies of Sciences in Asia, Republic of Korea, 67–104.
3. Grossman, J.M. & Porche, M. V. (2014). Perceived gender and racial/ethnic barriers to STEM success. *Urban Education*, 49 (6), 698-727.
4. Hammrich, P. L., Richardson, G. M., & Livingston, B. D. (2000). Sisters in Science: Confronting equity in science and mathematics education. *Journal of Women and Minorities in Science and Engineering* 6 (3) 207-220
5. Huyer, S., & Halfkin, N. (2013). India's slow progress in advancing Women in science and technology. Retrieved on January, 29,2019 from <https://www.elsevier.com/connect/study-reports-indias-slow-progress-in-advancing-women-in-science-and-technology>
6. Jerrim, J. & Schoon, I. (2014). Do teenagers want to become scientists? A comparison of gender differences in attitude toward science, career expectations, and academic skill across 29 countries. In I. Schoon & J. S. Eccles (Eds.), *Gender Differences in Aspirations and Attainment: A Life Course Perspective*. UK: Cambridge University Press.
7. Scanlon, E. (2000). How gender influences learners working collaboratively with science simulations. *Learning and Instruction*, 10, 463-481.
8. Silver, A. & Rushton, B. S. (2008). Primary-school children's attitudes towards science, engineering, and technology and their images of scientists and engineers. *Education* 3-13 36(1) 51-67.
9. Schumacher P., Morahan-Martin J. (2001). Gender, internet and computer attitudes and experiences. *Comput. Hum. Behav.* 1,7 95–110.
10. Weisgram E. S., Bigler R. S. (2006). Girls and science careers: the role of altruistic values and attitudes about scientific tasks. *J. Appl. Dev. Psychol.* 27 326–348.
11. <https://feminisminindia.com/2017/11/08/global-gender-gap-report-2017/>

12. Women Scientists in India. Retrieved on 10 Dec from http://www.ias.ac.in/public/Resources/Initiatives/Women_in_Science/AASSA_India.pdf
13. Women in Science and Technology in Asia. *The Association of Academies and Societies of Sciences in Asia (AASSA)*. Retrieved on 10 Dec from <http://www.interacademies.net/File.aspx?id=28016>
14. The Global Gender Gap Report 2017. Retrieved on 10 Dec from http://www3.weforum.org/docs/WEF_GGGR_2017.pdf