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An Overview On Association Of Women In The Field Of Science

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Abstract: ***In India the participation of women in the field of science is quite low though there is no apparent gender discrimination in our country. In this article, the factors which create obstacles for women to pursue careers in the field of science and some recommendations suggested by some other studies were analysed.***

Keywords: Women, Science

I. INTRODUCTION

In the present day we see women taking every job even those considered masculine before. So we find number of women studying science but women in science remain fairly scarce by proportion. However, it is reported (Bal, 2005) higher rate of enrolment and success of women in medical and biological discipline in comparison to other fields of science and technology. Inaugurating the 5th Women's Science congress Human Resource Development minister Smriti Irani (The Assam Tribune, Guwahati, 2016) said prejudice against female scientists dramatically exists. It is a fundamental challenge that needs to be addressed. She further claimed that no school-going child in the country in this day and age would be able to name an Indian female scientist. Though there are many women who have done well in their scientific and academic career not many are seen being awarded and rewarded. To cite an example of this is that Shanti Swarup Bhatnagar Award, one of the most prestigious award by Council of Scientific and Industrial Research (CSIR) annually only 16 women out of over 450 total awardees since 1958 have received it until 2015. Another award by CSIR is Young Scientist Award where 21 women scientist were awarded out of 171 scientists till 2014. A study reported that the ratio of Indian women scientists actually entering the workforce is very less with women constituting only 15% of total manpower engaged in research and development in science and technology (Bal, 2005). Only 7% women faculty were found at prestigious Indian academic institution like the Indian Institute of Science (IISc) and Indian Institute of Technology (IITs) (Indian National Science Academy, 2004; Gupta, 2007). An analysis of the gender distribution of PhDs in the Science fields show that men have received higher number of PhDs (70.8% of Science PhDs) than women (29.2 %), (Kurup and Arora, 2010). A joint study conducted by the CSIR and the National Institute of Science and Technology and Development Studies (NISTADS) in which 9,957 papers published (2008-09) by Indian Scientists were analyzed showed only 3.4% were contributed by women scientists exclusively and 47% were jointly authored by male and female scientists(Garg and Kumar, 2014).

This phenomenon is not restricted to India alone but is actually a global concern as reported in some studies that the presence of women in the fields of science, technology and innovation remains significantly lower than that of men, even in some of the world's wealthiest regions (Etzkowitz and Gupta, 2006; Muhlenbruch and Jochimsen, 2013).

One study (Sinha and Sinha, 2011) has also been carried out in North East India with an intention to analyse the status of women scientists of this part of our country. The study reported that there is an incredible difference between the number of men and women scientists working in different institutions, especially in the area of basic sciences, i.e. physics, chemistry and mathematics.

Predicting whether the female researchers of tomorrow will outnumber their present-day counterparts crucially involves looking to today's girl enrollment in higher secondary and undergraduate level of science streams. The programs in the undergraduate levels are divided into those of general courses such as arts (BA) and pure sciences (B.Sc) on

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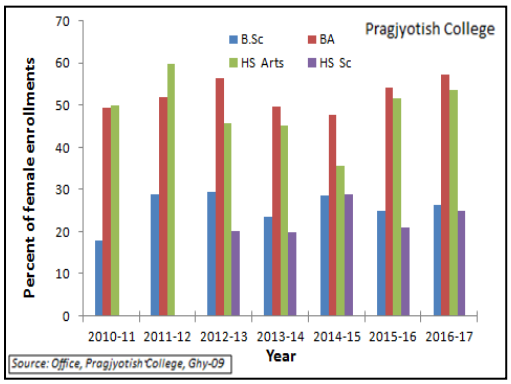
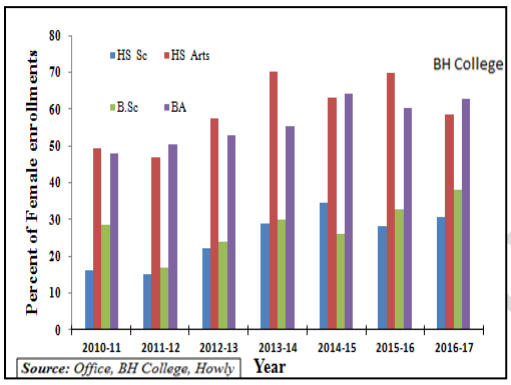
one hand and the professional courses such as engineering, medical, law, agriculture etc. on the other hand. Before discussing we can have a look at the percentage of females enrolled in different streams in three randomly selected colleges of Assam in the Higher Secondary and undergraduate level over the last few years. Here the data of the general courses of the three co-educational provincialized colleges of Assam has been included just to get a glimpse of the situation. Figure 1 shows the enrollment pattern of females in these colleges of Assam by streams over last few years.



(a)



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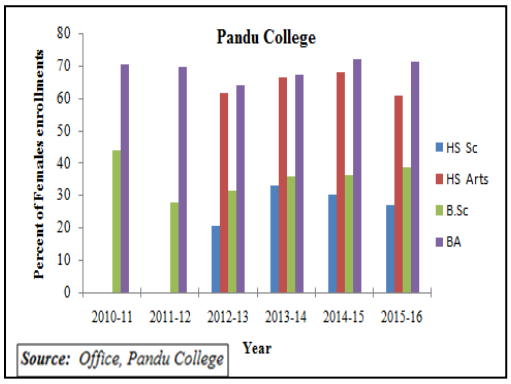

(c)

Figure 1: Percent of Females enrollment in Higher Secondary and Undergraduate levels in Arts and Science Stream of (a) Pragjyotish College (b) BH College, Howly (c) Pandu College

Thus, from the Fig 1, it is clear that the enrollment percentage of females in science for both Higher Secondary and graduate level is less compared to boys for all the colleges. The percent of female enrollment in HS (Sc) for the year 2010-11 and 2010-12 of Pragjyotish College and the percent of female enrollment in HS (Sc) and HS (Arts) for the year 2010-11 and 2010-12 of Pandu College is not mentioned as there was no admission in the respective streams for those two sessions. The data for the year 2016-17 for Pandu College was also not considered. So, it is revealed small percentage of female in science at the Higher Secondary and the undergraduate level which limits the potential growth in female representation along the academic pipeline—i.e. at the postgraduate, doctoral and post-doctoral levels. Therefore, the transition from high school to college level is a critical time for young women in science.

II. WHY WE NEED WOMEN IN SCIENCE?

Utilization of the talents of women in science should not be viewed only from the perspective of gender equity. It must be realized that full involvement of women in scientific and technological field is today essential for rapid economic and sustainable development. Many studies from time to time have been carried out and recommended that research team should include both men and women. Some studies (Barjak and Robinson, 2008; Evans et al, 2007) revealed that a heterogeneous composition could increase research quality by incorporating the different perspectives and approaches of men and women. Women help diversify research and helps in bringing different points of view that can fuel creativity and result in better quality outputs. For example a study (Ashcraft and Anthony, 2006) reported that American IT patents produced by mixed-sex teams had higher citation rates than those produced by male-only or female-only teams. Lack of gender diversity in science and technology limits workplace performances. One study (Scott E Page, 2007) has shown that more diverse teams consistently produce more accurate and successful solutions to complex situations and are less likely to make significant mistakes. The lack of a strong female presence means women have little say in decisions that could make the world a better place, even when they rise to the top of other fields. So, under-representation in science is not just a problem for women but a problem for larger society.

III. WHY A FEW WOMEN?

Some studies (Gupta and Sharma, 2003; Subramaniam, 2007; Kumar, 2009) carried out in India have indicated that gender-bias come in the way of women scientists creating roadblocks in their careers. Some studies reveal several explanations for the low numbers of women in the field of science which are briefly highlighted below.

A. INHERENT GENDER BIAS

Till today myths are there that boys are better at mathematics and science than girls. These false myths about girls have been fostered and passed down through generations. Spelke (2005) analyzed all the available research in tests done from birth to maturity and observed that males and females have the same aptitude for math and science. Sociologists Leahey and Guo (2001) at the University of North Carolina

looked at 20,000 math scores of kids age 4 to 18 and found no differences of any magnitude between males and females. While it may be easy to disprove these myths scientifically they will not be so easy or quick to remove from entrenched cultural attitudes.

B. LACK OF ENCOURAGEMENT

Girls receive a number of signals from a very early age that discourage them from entering science fields. As students, girls often believe that science is not for them. Many times, they never have the chance to develop a love for science.

C. THE CONFIDENCE GAP

Social psychological research reveals that the stereotype that girls are not as good as boys in math can have negative consequences. If girls are made aware of this stereotype they perform much more poorly than boys however when they are told that boys and girls perform equally well on a test, there is no gender difference (Walton and Spencer, 2009; Nguyen and Ryan, 2008). Girls are internalizing this stereotype and talking themselves out of achieving in math and science while they are doing just as well or better than boys. Sociologist Dr. Shelley Correll (2004) has found that even when girls have same levels of previous achievement in math girls rate their own abilities lower. The stereotypes enter into children mind at an early age don't just magically disappear when they get older. Instead, those stereotypes strengthen as children grow older and continue to explore the society that continually reinforces these stereotypes.

D. LACK OF ROLE MODELS

If girls see that most of their female mentors and senior female friends are not going to science they are less likely to go into those fields themselves. The study from North-east India (Sinha and Sinha, 2011) reported lack of mentoring to be the biggest problems for young researchers. Recently a study carried out in University of North Carolina (Elizabeth et al, 2016) found a positive and significant association between the proportion of female math and science teachers in high school and young women's probability of entering into the science field. There was no link between teachers' gender and the probability of picking a major in science for young men. However another study (Cheryan et al, 2015) suggests that the attitudes and messages that teachers convey can be more important than the teachers' gender.

E. FEWER WOMEN IN HIGHER SECONDARY OR GRADUATE SCHOOL

To get to the higher levels of academia women enrolment in this field should be increased but it is not found to be so as evident from the data shown in Fig.1. So, the transition between high school and college is a critical moment when many young girls turn away from a science career. Although girls are the majority in arts stream both in Higher Secondary and Graduate in General course, but the percent of girl's students in science stream both in Higher Secondary and Graduate in General course is less. This drop off of girls in science can be caused by a number of factors.

F. BALANCING FAMILY AND RESEARCH

Once a girl manages to hurdle these obstacles and successfully finishes her degree, new barriers emerge. After completion of post graduate courses their families wanted the student to complete her doctoral work so that she could settle down. The pursuit of postdoctoral studies did not seem to be an immediate option.

Though women in all professions face some common difficulties in balancing their domestic responsibilities and job requirements but in case of women engaged in scientific professions the matter is a bit tricky because it is observed that if people are away from research in science particularly experimental work even for six months their work gets left behind and they become irrelevant soon. Since competition to remain and advance in Science careers begins at the earliest stage soon after PhD, it is important for women to establish themselves during their early 30s (a period that coincides for most Indian women with marriage and family commitments). Moreover for postdoctoral study there is the need to spend years in another city where scientists can work in advanced labs. Many women are reluctant to relocate their spouses and children. Thus, as a compromise a large number of qualified women opt for under-graduate or school level teaching while some completely drop out of science.

Besides these there are other factors which results in a huge gap between the number of women who studied science and the number of women who continued to work exists. A joint study carried out by the Indian Academy of Sciences and the National Indian Academy of Sciences (Kurup et al, 2010) explored the reasons why women after completing a PhD in science drop out from scientific research women cited several organizational factors for dropping out. These included the lack of flexible timings, absence of job opportunities daycare facilities, accommodation and transport.

IV. RECOMMENDATIONS SUGGESTED FROM SOME STUDIES

Scholars from across multiple fields and disciplines, including sciences and social sciences from time to time analyse the nature of gender gap in sciences and are work on mitigating and treating gender differences.

One way we can help tackle this issue is by focusing as early as possible in the education cycle. We need to get young girls excited about math, science and technology in the school level. It is essential not just that more girls stay in science but also that they are taught science well, encouraged into science careers and helped to stay in them.

The media can play a key role in depicting women and girls as scientifically and technologically competent and capable. Textbooks and other educational materials can also perpetuate or question this bias. Exposing girls to successful female role models in mathematics and science is another way to reduce negative stereotypes and improve girl's performance and interest in mathematics and science.

It needs to be accepted that family responsibility is indispensable to any woman's life. Thus counselling programmes should be started for women research scholars on career planning without compromising on family needs and responsibilities. This would be helpful to women research scholars especially during the years for starting a family. Setting up of day care centres should become a mandatory requirement for teaching and research institutions. Flexible working hours would also be of immense help as that would enable women to balance their both domestic and social responsibilities while actively contributing scientifically. Creating awareness among women scientists about the possible support structures (institutional as well as personal) will help them to be successful in their career.

Getting more women scientists into top-level, decision-making roles in academia, government and industry can make a big difference to young women scientists by working at the grass-root level. They also offer aspiring researchers positive role models. More data disaggregated by gender is needed not only in the country level but also in the state as well as regional level which will provide a clear picture of women and girls' participation in science which in turn will help the policy makers.

Recognising the achievements of women scientists through award in the form of extra travel grants, extra funding for research etc is considered as another major global initiative. The purpose of these awards is to celebrate and promote notable success of women scientists, encourage more women scientists to engage in science research as well as provide female role models for younger generations.

V. STEPS TAKEN BY THE GOVERNMENT OF INDIA

The Indian government has come up with various steps that aim in bridging this gap. The CBSE has launched a project Udaan for girl students from all the Boards of India of Class XI and Class XII which provides free online resources for the preparation of admission test for the premier engineering colleges in the country. In the year 2000 Department of Science and Technology (DST), India has declared a National Award for Women's Development through application of Science and Technology. It aims to recognize the contributions of individuals/organizations who have worked at the grass root level for the women's development. Women Scientists Scheme (WOS) has been operated since 2003 which aimed at providing opportunities to women scientists and technologists between the age group of 27-57 years who had a break in their career but desired to return to mainstream. It has been broadly classified into WOS-A (projects related to the various fields of biological, chemical and physical sciences); WOS-B (fellowship for women scientists for societal programmes and WOS-C (Fellowship for creating self employment opportunities in Intellectual Property Rights. These fellowship schemes have been highly successful and encourage more and more Indian women to continue science as a career. In the year 2014, Department has restructured all the women specific programmes under one umbrella known as "KIRAN" (Knowledge Involvement in Research Advancement through Nurturing) which addresses various issues related with women scientists (e.g. unemployment, relocation etc.). In March 2016, The Ministry of Science and Technology constituted a Standing Committee for promoting representation of women in science and technology. In April 2016 the University Grants Commission announced relaxation of norms for female PhD candidates.

VI. CONCLUSIONS

The government is endeavouring to attract women into science by floating out schemes for them. Thus an active participation and inputs from all including social scientists and scientists will make it possible minimize the gaps. Thus there is a need that more women and girls take courses in science, technology and women's studies so that they can learn, understand and strengthen the connections between these fields and women's right and status.

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