

Women in Physics in India, 2005

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In this paper, we summarize the current situation for women in physics in India. As in most countries, the percentage of women in physics and other sciences is low [1]; however, the nature of the problem may be somewhat different in India, compared to many Western countries [2]. For example, there does not seem to be a general perception that women lack the intellectual skills required for a career in physics; instead, the problems seem to arise more from societal perceptions of appropriate roles for women. This suggests that one should develop strategies that are specifically catered to deal with the Indian situation. In the last few years, some promising measures have been introduced to improve the situation of women in science in India.

I. THE CURRENT SITUATION

Both the percentage and the number of women enrolled in universities has increased steadily in the last few decades, in all subjects, including science [1]. The enrolment of women in universities and colleges has grown from 3,96,745, (10.9%) in 1950-51 to a healthy 83,99,443 (39.4%) in 2000-2001. Of these, in 2000-2001, 39.4% of a total of 16,70,263, were enrolled in science (a slight increase from the 37% of a total enrolment of 12,27,359 in 1995-1996). The percentage enrolment of women in the sciences in 2000-2001 was 39% at the Bachelor's level, 42.5% at the Master's level and 37.2% at the Ph.D. level. It is fairly impressive that over a third of science students are women; these numbers compare favourably with much of the world.

The percentage of women in physics is comparable, with 30% enrolment at the Master's level, but drops sharply to about 20% at the Ph.D. level[3]. This situation is better than in engineering (where women constitute 21.8% of students at the Bachelor's level, 15.8% at the Master's level, and 16.5% at the Ph.D. level.) but worse than in medicine (44.4% at the Bachelor's level, 34.4% at the Master's level and 29.3% at the Ph.D. level).

However, the most serious problems for women in the sciences, above all in physics, start at the post-Ph.D. level. The number of women faculty members in the Departments of Physics of Indian universities and research

institutes is found to be dismal, rarely crossing even 10%. A survey of 8 premier research institutes [4] found 20 of the 245 researchers of the physics faculty were women, while the 7 Indian Institutes of Technology [5] had 16 women physicists as part of physics departments which had 201 faculty members. The universities fared little better, as 11 university physics departments[6] surveyed had only 30 women faculty members out of 258. Moreover, in many departments, this fraction has remained roughly constant over more than a decade.

What causes this precipitous drop in the percentage of women at the faculty level? The greatest contributory factors are probably increased responsibilities on women due to marriage and motherhood, as well as possible biases when hiring at the faculty level. Efforts to increase the percentage of women in physics should perhaps focus at this stage.

Further indicators of standing in the physics community (e.g., awards, memberships in scientific academies) exhibit an even more shocking scenario for women in physics. For example, the Bhatnagar award (the premier scientific award at the national level) has never gone to a woman physicist, and to very few women (8 out of a total of 333 awards) in other scientific disciplines. The number of women at the decision-making level (e.g., directors of institutes/laboratories, or members of grant awarding committees) is so low as to be almost negligible.

An important point which has not yet received sufficient notice is that most of the women in physics (and other sciences) come from urban backgrounds. Serious efforts to reach to women in non-urban areas are needed.

II. THE IMPACT OF THE PARIS CONFERENCE

The main impact of the first IUPAP International Conference on Women in Physics, held in Paris from March 7-7, on the situation of Indian women scientists has perhaps been an explicit recognition of the problems faced by women in physics. We have recognized the need to do something about the problem of the selective dropping out of women at higher levels. Networking among Indian women physicists has increased. This has also led to a more open acknowledgment of the problem of sexual and/or gender-based harassment, which had earlier been a taboo subject.

In order to raise awareness, there have been articles and talks by individual women scientists, including several of the team members who went to Paris[3].

Officially mandated policies in India are frequently supportive of women, e.g., it is mandated that all institutions have daycare facilities, and that they set up women's grievance cells to deal with complaints of sexual harassment, etc. However, we have realized that these recommendations have rarely been implemented in practice. Several of the team members have now managed to set up these women's grievance cells at their home

institutes, and other institutes have followed suit.

III. EFFORTS TO RAISE CONSCIOUSNESS OF WOMEN'S PROBLEMS

A panel on women in science was arranged at the annual meeting of the Indian Academy of Sciences, held in Guwahati in November 2003. There was also an International Conference on 'Women in Science: Is the glass ceiling disappearing?' in March 2004 in New Delhi, where there were discussions about barriers to women's progress in the science and engineering disciplines. This conference brought together working scientists, and social scientists who studied gender issues. The international conference 'Statphys', held in Bangalore in 2004, had a special session on women in physics. An important point which came up was that while individual scientists might have faced no discrimination, the statistics indicated that there was cause for concern. The IUPAP conference on Physics Education to be held in New Delhi in August 2005 has also scheduled a session on 'Nurturing women in physics' which hopes to concentrate on ways in which physics can be taught which encourage and nurture women.

IV. FELLOWSHIPS AND INCENTIVES

At the Government level, the Department of Science and Technology has initiated special fellowships to enable women to get back into science after a break in their career. This scheme provides funding for up to three years. In the three years since this scheme was begun, about 600 women have benefitted from it. The Department of Science and Technology also relaxes the age limit for various schemes by 5 years for women, to allow for the fact that they may have had a break in their career. The scientific advisory committee to the Prime Minister is also looking at concrete measures to increase the number of women in science. The University Grants Commission (the supervisory board for universities) has announced 50 postdoctoral fellowships per year for women with a break in career. The L'Oreal foundation has started in Mumbai, a special fellowship for girls to pursue science, based on merit and need.

V. INITIATIVES BY SCIENTIFIC ACADEMIES

Two of the major scientific academies in the country have recently paid attention to the problems of women in science. The Indian Academy of Sciences constituted in January 2003 a Committee on "Women in Science". The convenor of this committee was Prof. Rohini Godbole, one of the members of this group and an invited speaker at the Paris Conference. This committee has recommended several measures to the Council. These have

been accepted and the implementation of some measures such as getting a larger database of statistics and information about women in science has already started. The committee has also suggested starting a role model programme, which will involve mentoring, and holding special lectures and workshops for girl students in science, etc. The committee has also formulated plans for books, etc., which give biographical sketches of eminent women scientists.

The Indian National Science Academy constituted a committee to examine why there are so few women in science. This committee commissioned a survey, conducted by the SNDT University (Sreemathi Nathibai Thakersey University), Mumbai which obtained information on the hurdles faced by women who pursue scientific careers. This committee has brought out a report entitled 'A science career for Indian women' which examines various aspects of the societal problems faced by Indian women in the pursuit of science, and makes several concrete recommendations[7].

VI. RECOMMENDATIONS MADE

The following recommendations, most of which are in line with the IUPAP resolutions at Paris and Rio, have been made by several of the above bodies.

- Efforts to dispel gender-related differences in learning abilities are recommended. Special attention needs to be given to the inclusion of under-represented categories. New support systems may be necessary to achieve these objectives. Science camps for girl students, and the organization of efforts to support and increase the number of girls participating in competitive entrance exams (e.g., for engineering colleges) have been suggested.
- It has been realised that it is necessary to offer incentives to institutions to hire women, and make it possible for spouses to work at the same institution (this has been a problem for many women scientists).
- Organisational structures need to be modified to make work-places more women-friendly. Creches, flexible timings and part-time jobs have been recommended. Some flexibility in rules regarding leave, age limits, etc., is suggested.
- Sustained efforts to ensure that competent women scientists are given high visibility, speaking slots in conferences and memberships of decision-making bodies are required.
- Grievance cells for sexual offences and discrimination have been mandated at institutional levels in all government bodies; it should be ensured that all

institutes comply with this requirement. The possibility of referring certain cases to a central cell for redressal has also been recommended.

VII. LACUNAE

Unfortunately, the measures mentioned above may not solve the problems faced by women in getting the past the barrier of the first faculty position. Concrete measures to

lower this barrier are called for. The exclusion of women from informal networks of professionals is still difficult to overcome. The conscious and unconscious discouragement faced by young women who want take up careers needs to be countered by support groups and mentors, which do not now exist to any great extent. The ‘invisibility’ of women to peer groups which recommend career advancement of various types still persists. Finally, there are very few initiatives specific to women in physics as opposed to women in science.

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- [1] University Grants Commission, University development in India-basic facts and figures on institutions of higher education, students enrolment, teaching staff. Report, University Grants Commission (Information and Statistics Bureau, New Delhi), 1995-96 to 2000-2001.
- [2] N. Gupte, J. Gyanchandani, S. Nair and S. Rao in ‘Women in Physics’, Proceedings of the Women in Physics Conference, March 8th-10th, Paris, 2002 (AIP, 2003).
- [3] R. Godbole, N. Gupte and S. Rao, Women in Physics, Meeting reports, Current Science, **83**,359(2002).
- [4] Institutions surveyed: Tata Institute of Fundamental Research, Mumbai, The Institute of Mathematical Sciences, Chennai, S.N. Bose Center for Basic Sciences, Kolkata; Harish Chandra Research Institute, Allahabad; Insitute of Physics, Bhubaneshwar; Raman Research Institute, Bangalore; Indian Institute of Science, Bangalore; Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore.
- [5] All the seven IIT-s located at Mumbai, Delhi, Chennai, Kanpur, Kharagpur, Guwahati and Roorkee are included.
- [6] Universities surveyed: Delhi University, University of Hyderabad, Jawaharlal Nehru University, Pune University, Mumbai University, Madras University, Calcutta University, Madurai Kamaraj University, Panjab University, Chandigarh, M.S. University, Baroda, Banaras Hindu University.
- [7] A science career for Indian women, An examination of Indian women’s access to and retention in scientific careers, A report-2004. (Indian National Science Academy, 2004).