

# **Improvement of Women's Education in India and Few Inspiring Indian Women in Science and Technology**

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## **Abstract:**

Education has the power to open human's third eye, flooding him with spiritual and divine light. Education can change human life in every aspect. India is the world's second most populous country and about 1.4 billion people live here. About half of this numbers are women and they are one of the most important national resources. To improve the quality of life at home and outside, women's education plays a very important role. An educated woman can help in the reduction of infant mortality rate and growth of the population. The cultural growth and development of the future generations depend more on women. From the vedic period to the 21<sup>st</sup> century, various steps have been taken to spread women's education in India and as a result the number of women participating in various fields has been increasing. In this paper I am trying to focus on the development of women education in India along with the examples of some inspiring women in science and technology.

## **Keywords:**

Women education, Government Policies, Science and Technology, Successful women.

## **Improvement of Women Education in India and Few Inspiring Indian Women in Science and Technology**

As a developing country India's biggest problem is population explosion and illiteracy (mainly in women). Although emphasis has been placed on women's education, but till now women are lagging behind in education due to various reasons and India has one of the lowest female literacy rates in Asia. This low level of literacy not only has a negative impact on women's lives but also on their families' lives. It also negatively affects economic development of the respective countries. Promoting gender equality is not just to make sure that women get a chance to give expression to their creativity and abilities but also because it is essential for the balanced development of any society. For instance, a recent survey in India found that infant mortality was inversely related to mother's educational level and the lack of an educated population can be an impediment to the country's economic development. Various developmental initiatives for women education has been taken by the government like, Beti Bachao Beti Padhao, Sukanya Samridhhi Yojana, Kanyashree Prakalpa etc. Despite of all difficulties there

are a large number of women who established themselves and reached at top and created a history for others. In this article we can find the examples of such great Indian women who established themselves in Science and Technology stream.

### **Women education in different periods of time:**

**Women Education in Vedic Period:** In Vedic times women enjoyed a high social status and parity in all walks of life. Though the son was given the major position in the family, the daughter was equally allowed to all the privileges given to a son. At this period female education was very much appreciated. During post Vedic times, education of women declined and the situation became more circumscribed as religion became increasingly institutionalized.

**Women Education in Buddhist Period:** Buddhism was a rising against the unbending Hindu culture. Again women were assigned equivalent position and they attained remarkable success and achieved fame in the sphere of education, culture and spiritual potentialities.

**Women Education in the Times of Jainism:** This was another golden age for women and it showed magnificently what heights women could reach. Women were given full facilities for the highest kind of education which was spiritually oriented.

During post-puranic period, the position of women deteriorated much more though, few famous lady scholars, poetesses flourished during the first millennium of the Christian era. The marriageable age again decreased to 9 or 10 by the 8<sup>th</sup> and 9<sup>th</sup> centuries and both girls and their parents concentrated more on the marriage than education. That was a depressing period for women education.

**Women Education in Medieval Period:** Due to the pardah system during Muslim rule, the percentage of female literacy went down further at this period. In Northern India due to the strict execution of the pardah system, women enjoyed very little chance to get higher education by attending educational institutions. However, in South India where the force of Muslim Conquest was not felt much as compared to Northern India, the pardah did not have much acceptance. The negligence to women literacy was so remarkable that there was hardly one literate woman in a hundred women by the beginning of the 19<sup>th</sup> century. Few rich Hindu and Muslim women received religious education at home.

**Women Education in British Era:** At the beginning of the British rule, education among female had practically disappeared, but afterwards it opened a new chapter in Indian women's educational history. Due to the political as well as economic interest the British Government made a serious attempt in women's education during their tenure. They made excessive efforts to set up schools and colleges in various parts of the country and bore the financial burden of girl's education. In 1820 David Hare established a school for girls in Calcutta and conducted it at his own expense. But most of these girl's schools were concentrated in the urban areas, thus the girls of rural areas were deprived of their right to education.

Bethune school of Calcutta developed into a college, which was the first institution of higher education for women. Though Calcutta, Bombay and Madras Universities were established in 1857, women were not permitted to take admission. Around 20 years later, in 1877 Calcutta University allowed women candidates to take the examinations. The Christian missionaries and private individuals made remarkable progress in this regard. By 1882, there were 15 training institutions for women teachers.

### **Contributions of Great Social Reformers in Development of Women Education:**

Many great social reformers began to provide their support to the education of women. They were very much influenced by the western liberal and democratic ideas. Raja Rammohan Roy played an important role in the abolition of sati pratha and also emphasized the need for their education. Pandit Ishwarchandra Vidyasagar was another social reformer who established a number of girl's schools in Bengal. Keshab Chandra Sen and Swamy Dayanand Saraswati were also supported female education and widow re-marriage.

Swami Vivekananda, a staunch disciple of Sri Ramkrishna laid great emphasis on the education of women. He held the sturdy faith that women should be taught the value of liberty ,self-initiative and heroism. His disciple Sister Nevadita an English woman carried forward his legacy of women's education in India.

Gandhiji by giving a proud position to women in the national liberation movement kindled in them a new light and a new urge for serving the nation. Netaji Subhas Chandra Bose inspired many Indian women to join the freedom struggle and formed the Jhansi battalion for his Azad Hind Fauj.

### **Major Recommendations on Women Education:**

After independence several committees and commissions were appointed to suggest measures for the improvement of women education. They are as follows:

1. University Education Commission (1948-49)
2. National Committee on Women Education (1958-59)
3. The National Council of Women's Education (1962)
4. Bhakta vatsalam Committee (1963)
5. The Kothari Commission (1964-66)
6. The National Policy on Education (1986)
7. Programme of Action, 1992
8. RTE Act (2009)
9. Beti Bachao Beti Pathao
10. Sukanya Samriddhi Yojana
11. Balika Samriddhi Yojana

12. National Scheme of Incentive to Girls for Secondary Education
13. Kanyashree Prakalpa
14. Sabooj Sathi Bicycle Distribution Scheme

### **Reasons behind lack of Women Education in India:**

Although the government has taken several steps to improve women's education, women are still lagging behind in education due to various reasons such as-

1. Suitable Curriculum for the education of girls
2. Lack of social consciousness among female
3. Scarcity of lady teachers
4. Lack of proper physical facilities
5. Unwillingness of female teachers to serve in rural areas
6. Financial difficulties
7. Transport problem
8. Problem of co-education

### **Notable women personalities in India (since 19<sup>th</sup> century):**

India is a land of contradictions: it has had a powerful woman prime minister, a woman president, it has a large number of very highly accomplished women and at the same time it rates extremely low in the treatment of the average woman. Here are some examples of such Indian women who broke the glass ceiling –

1. **Anandi Gopal Joshi (1865-1887):** She became a mother when she was only 14 and lost her baby in ten days. Despite of various burdens Anandibai began her medical training in the United States and she graduated with MD in 1885. After that she became the physician-in-charge of the local Albert Edward Hospital in the princely state of Kolhapur in 1886. She died in 1887 of tuberculosis at the age of only 22.
2. **Kadambini Ganguly (1861-1923):** She graduated in western medicine from Calcutta Medical College in 1886 and after Anandibai, she was the 2<sup>nd</sup> women in India to be eligible to practice medicine. As a doctor she broke the myth and became the first woman to be on the dais at a session of the Indian National Congress. She died in 1923 after return from a house call when medical aid failed to reach her.
3. **Janaki Ammal (1897-1984):** The pioneering botanist developed a sweeter variety of sugar cane and her research is what added that extra bit of sweetness to our sugar. Ammal joined the John Innes Horticulture Institute at London during 1940 to 1945 and in 1951 she returned to India after a personal invitation from Pandit

Jawaharlal Nehru. Dr. Ammal was conferred the Padma Shri in 1977 and died in 1984 while working at a laboratory in Chennai.

4. **Irawati Karve (1905-1970):** The Berlin University conferred on Irawati Karve the D. Phil degree for outstanding research in anthropology in the year 1930 and she was appointed Head of the Department of Sociology and Anthropology at the Deccan College Post-graduate Research Institute of Pune. Her prominent work, 'Yuganta: The End of an Epoch', is a historical rendering of the Mahabharata. Karve was the first female author from Maharashtra to receive Sahitya Academy Award for Marathi in 1968.
5. **Kamala Sohonie (1912-1997):** Kamala's study deals with the nutritional elements in common foods such as milk, pulses and legumes. Sohonie was in a tussle with Prof. C. V. Raman but her dedication encouraged Prof. Raman to induct women in research. Kamala Sohonie received the Rashtrapati Award for her work.
6. **Asima Chatterjee (1917-2006):** She worked in the fields of organic chemistry and phytomedicine and developed an epilepsy drug called Ayush-56 along with several anti-malarial drugs. She became the first woman to be awarded the Shanti Swarup Bhatnagar Prize in 1961.
7. **Anna Mani (1918-2001):** She worked with Sir C. V. Raman for her doctoral thesis from 1940 to 1945. Her passion for climate science made her take remarkable ventures. Anna Mani started a company in the industrial suburbs of Bangalore that made precision instruments to measure solar radiation and wind speed.
8. **Rajeshwari Chatterjee (1922-2010):** She was the first woman engineer from the state of Karnataka. Her contribution to the field of microwave and antennae engineering in the country was truly pioneering. She received the Mountbatten prize, J. C. Bose Memorial prize and award for the best research and training from different institutes.
9. **Archana Sharma (1932-2008):** Prof. Sharma contributed to the study of chromosomes by evolving a new technique of chromosome visualisation. She was awarded the Padma Bhushan, Shanti Swarup Bhatnagar Prize, Birbal Sahni Medal, G. P. Chatterjee Award and the FICCI Award for her excellent works.
10. **Bimla Buti (b. 1933):** She did her PhD with Nobel Laureate Prof. Subrahmanyam Chandrasekhar at University of Chicago. She worked at various NASA centres and in India she did her research at Physical Research Laboratory, Ahmedabad. She started Buti Foundation in 2003 and had instituted many awards for young scientists and women scientists.

11. **Mahtab S. Bamji (b. 1934):** She made significant contributions in the field of nutritional biochemistry and was selected to receive the Living Legend Award of the International Union of Nutritional Sciences in 2017. At present she contributes to the efforts of improving the nutrition and health status of poor farmers and villagers on the outskirts of Hyderabad.
12. **Darshan Ranganathan (1941-2001):** She was popular for reproducing natural biochemical processes in the laboratory and was a specialist in designing proteins to hold a wide range of different conformations. She wrote many books and was the Deputy Director at IICT Hyderabad.
13. **Indira Nath (1938-2021):** She completed her MBBS from the All India Institute of Medical Sciences and became the head of the new Department of Biotechnology at AIIMS. Her major contribution deals with mechanisms underlying immune unresponsiveness in humans and nerve damage in leprosy. Dr. Nath was awarded Padma Shri, L'OREAL-UNESCO Award and Shanti Swarup Bhatnagar Prize.
14. **Sudipta Sengupta (b. 1946):** She carried out research work for 3 years at Imperial College, London and She conducted pioneering geological works in the Schirmacher Hills of East Antarctica. She is one of the first Indian women to set foot on Antarctica. She was awarded Shanti Swarup Bhatnagar Prize, National Mineral Award, Antarctic Award, D. N. Wadia Medal of INSA.
15. **Manju Ray (1947-2021):** Her pioneering work deals with the development of non-toxic anticancer drug. She was Senior Prof. And Dean, IACS Kolkata and she was an Emeritus Scientist at Bose Institute, Kolkata. She awarded Shanti Swarup Bhatnagar Prize, Indian National Science Academy Young Scientist Medal, Life Time Achievement Award by Indian Chamber of Commerce and many others.
16. **Raman Parimala (b. 1948):** She is an Indian mathematician known for her contributions to algebra. She is the Arts & Sciences distinguished Professor of mathematics at Emory University. For many years, she was a professor at Tata Institute of Fundamental Research (TIFR), Mumbai. Dr. Parimala was awarded Shanti Swarup Bhatnagar Prize in 1987. She was the fellow of the Indian Academy of Sciences, Indian National Science Academy and American Mathematical Society and received Honorary doctorate from the University of Lausanne, Srinivas Ramanujan Birth Centenary Award and TWAS Prize for Mathematics.
17. **Shashi Wadhwa (b. 1948):** She was the Head of the Department of Anatomy and Dean AIIMS and conducted various researches on neurobiology, quantitative morphology. She awarded Shanti Swarup Bhatnagar Prize, B. K. Bachhawat Lifetime Achievement Award.

18. **Vijayalakshmi Ravindranath (b. 1953):** Prof. Ravindranath obtained her Ph.D. from the University of Mysore and her area of research was in neuroscience. She is an elected Fellow of Indian Academy of Sciences, Indian National Science Academy, National Academy of Sciences, National Academy of Medical Sciences, Indian Academy of Neurosciences and Third World Academy of Sciences. She was awarded Shanti Swarup Bhatnagar Prize and also Padma Shri.
19. **Rama Govindrajan (b.1962):** She was the faculty at TIFR Centre for Interdisciplinary Sciences, Hyderabad; faculty at Jawaharlal Nehru Centre for Advanced Studies; Scientist at National Aerospace Laboratories Bengaluru. She was awarded Shanti Swarup Bhatnagar Prize in 2007.
20. **Sujatha Ramodorai (b. 1962):** She did her Ph.D from Tata Institute of Fundamental Research. She is an algebraic number theorist known for her work on Iwasawa theory. She was awarded Shanti Swarup Bhatnagar Prize in 2004 and also awarded ICTP Ramanujan Prize and Padma shri.
21. **Charusita Chakravarty (1964-2016):** She did her Ph.D from University of Cambridge in Theoretical Chemistry and her research was largely in the study of water and its anomalous properties, ionic liquids, phase transition in classical and quantum clusters. She was awarded Shanti Swarup Bhatnagar Prize, B. M. Birla Award and elected fellow of Indian Academy of Sciences and Indian National Science Academy.
22. **Vidita Vaidya (b. 1970):** Her primary areas of research are neuroscience and molecular psychiatry and she is the Professor at TIFR, Mumbai. Dr. Vaidya was honoured by Shanti Swarup Bhatnagar Prize and National Bioscience Award for Career Development.
23. **Aditi Sen De (b. 1974):** Her areas of research mainly covered quantum Information and computation, quantum optics, foundation of quantum mechanics and condensed matter physics. She is the Professor at Harish Chandra Research Institute, Allahabad and awarded Shanti Swarup Bhatnagar Prize in 2018.
24. **Shubha Tole (b. 1967):** She is an Indian neuroscientist, professor and principal Investigator at the Tata Institute of Fundamental Research in Mumbai, India. Her research investigates the development and evolution of the mammalian brain. In 2014, she won the Infosys Prize in the Life Sciences category and awarded the Shanti Swarup Bhatnagar Award (2010).
25. **Sanghamitra Bandopadhyay (b. 1968):** She is an Indian computer scientist specializing in computational biology. A professor at the Indian Statistical Institute, Kolkata, she is a Shanti Swarup Bhatnagar Prize winner in Engineering

Science for 2010, Infosys Prize 2017 laureate in the Engineering and Computer Science category and TWAS Prize winner for Engineering Sciences in 2018.

26. **Yamuna Krishnan (b. 1974):** She was earlier a Reader in National Centre for Biological Sciences, Tata Institute of Fundamental Research, Bangalore, India. Krishnan won the Shanti Swarup Bhatnagar Prize for science and technology, the highest science award in India in the year 2013 in the Chemical Science category.
27. **Ganandeeep Kang (b. 1962):** She is an Indian Microbiologist and virologist who is the Professor in the Department of Gastrointestinal Sciences at the Christian Medical College, Vellore, India. She worked on diarrhoea diseases and public health in India since the early 1990s. She is a key contributor to rotavirus epidemiology and vaccinology in India and awarded the prestigious Infosys Prize in Life Sciences in 2016.
28. **Rohini Godbole (b. 1952):** She is an Indian physicist and academic specializing in elementary particle physics: field theory and phenomenology. She is currently a professor at the Centre for High Energy Physics, Indian Institute of Science, Bangalore. She has worked extensively on different aspects of particle phenomenology over the past three decades, in particular on exploring different aspects of the Standard Model of Particle Physics (SM) and the physics beyond it (BSM). She was honoured by Padma Shri for her contributions in science and technology (2019).
29. **Tessy Thomas (b. 1963):** She is an Indian scientist and Director General of Aeronautical Systems and the former Project Director for Agni-IV missile in Defence Research and Development Organisation. She is the first ever woman scientist to head a missile project in India. Tessy Thomas received the Lal Bahadur Shastri National Award for her contribution for making India self-reliant in the field of missile technology.
30. **Ritu Karidhal (b. 1975):** Dr. Karidhal is an Indian scientist working with the Indian Space Research Organisation (ISRO). She was a Deputy Operations Director to India's Mars orbital mission, Mangalyaan. She played a key role in the development of India's Mars Orbiter Mission, Mangalyaan, dealing with the detailing and the execution of the craft's onward autonomy system. She received the ISRO Young Scientist Award in 2007 from A. P. J. Abdul Kalam, the ex-president of India.
31. **Kamal Ranadive (1917-2001):** She was an Indian biomedical researcher known for her research on the links between cancer and viruses. She was a founding member of the Indian Women Scientists' Association (IWSA). She worked at the Tata Memorial Hospital. Ranadive, on her return to India, rejoined ICRC and started her professional career as a Senior Research Officer. She was instrumental



in establishing Experimental Biology Laboratory and Tissue Culture Laboratory in Bombay. Ranadive was awarded the Padma Bhushan (India's third highest civilian award) for Medicine, in 1982.

32. **Violet Bajaj (1917-2020):** Dr. Bajaj worked at Biochemicals Unit, set up under CSIR, from the 1950s until her retirement. She was a contemporary of Rajeswari Chatterjee and Anna Mani.
33. **Maharani Chakravorty (1937-2015):** Chakravorty did her PhD on microbial protein synthesis from Bose Institute, Kolkata. She demonstrated cell free protein synthesis with a particulate preparation from *Azotobacter vinelandii*. She organized the first laboratory course on recombinant DNA techniques in Asia and Far East in 1981.
34. **Manju Sharma (b. 1940):** She is an Indian biotechnologist and administrator of several scientific research and policy-making bodies in India. She was most recently the president and executive director at the Indian Institute of Advanced Research in Gandhinagar, Gujarat. She was the first woman president of the National Academy of Sciences.
35. **Soumya Swaminathan (b. 1959):** She is an Indian paediatrician and clinical scientist known for her research on tuberculosis and HIV. From 2019 to 2022, she served as the chief scientist at the World Health Organization under the leadership of Director General Tedros Adhanom Ghebreyesus. She was the fellow of National Academy of Sciences and Indian Academy of Sciences, Bangalore.
36. **Renu Swarup:** She is an Indian geneticist and former Secretary, Government of India, formerly heading the Department of Biotechnology (DBT), Ministry of Science and Technology. She has actively contributed in the formulation of India's Biotechnology Vision and Strategy. She is credited with the establishment of India's largest microbial resource centre, Microbial Culture Collection. She won TWAS Regional Prize in Science Diplomacy (2018).
37. **Kiran Mazumdar Shaw (b. 1953):** She is an Indian billionaire entrepreneur. She is the executive chairperson and founder of Biocon Limited and Biocon Biologics Limited, a biotechnology company based in Bangalore, India and the former chairperson of Indian Institute of Management, Bangalore. In 2014, she was awarded the Othmer Gold Medal for outstanding contributions to the progress of science and chemistry.

### Conclusion:

There are several issues that women scientists face that stem from innate prejudice and bias, as well as patriarchal attitudes in the workplace. In addition there is widespread gender

insensitivity as well as explicit sexual harassment. Despite of all these burdens there are several examples of successful women in various fields of science and technology. Improving the participation of women in science and technology in India requires a multifaceted approach that addresses various social, cultural, and institutional factors. Here are some key aspects that can contribute to increasing women's participation in these fields:

- **Education and Awareness:** Enhancing access to quality education for girls and promoting science and technology education can create a strong foundation for their participation in these fields.
- **Role Models and Mentoring:** Providing female role models and mentors in science and technology can inspire and guide young girls to pursue careers in these fields.
- **Creating Supportive Policies:** Implementing policies that promote gender equality and inclusivity in science and technology is crucial. This includes initiatives such as gender-neutral hiring practices, promoting work-life balance, and establishing support networks for women in these fields.
- **Addressing Stereotypes and Bias:** Combating societal stereotypes and biases that discourage women from pursuing science and technology careers is essential.
- **Encouraging Research and Innovation:** Providing opportunities for women to engage in research, innovation, and entrepreneurship is crucial.
- **Networking and Collaboration:** Encouraging networking and collaboration among women scientists, technologists, and industry professionals can foster a sense of community and support.
- **Engaging with Communities:** Engaging with local communities, families, and schools is important to challenge gender biases and create a supportive environment for women in science and technology.
- **Empowering Women in Leadership Roles:** Promoting women to leadership positions in science and technology organizations can inspire and empower other women to follow suit.

It is important to recognize that these initiatives require sustained effort and collaboration between government, educational institutions, industry, and civil society organizations to bring about lasting change. So we should follow them and go forward.

#### **Acknowledgement:**

Dr. Sukla Nandi is thankful to Chandrakona Vidyasagar Mahavidyalaya for giving her the platform and Basantidevi College for giving this opportunity.

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