## Abstract

Science education has undergone a paradigm shift at the turn of new millennium. It is not a passive process but is an active construction and interpretation of experiences. Learning is a ‘treasure within’ and scientific knowledge is being actively built up and constructed by the learners. For constructivists, learning is viewed as an interaction between the learner and the learning environment. During this interaction prior knowledge becomes the root to construct new understanding leading to new innovations and forms the basis for research. In effect, learning is a process in which the learner explores new ideas. Science’s role in improving quality of life is now more prominent than ever. And according to the United Nations Education, Scientific and Cultural Organization (UNESCO, 2007), women’s active inclusion and participation in science education is crucial. Encouraging women to take part in science especially in higher education would allow the country to maximize its valuable human assets, empower its women, and improve its economic prospects. This paper is an attempt to enhance women participation in scientific research especially with respect to higher education.

## Introduction

Science education has undergone a paradigm shift at the turn of new millennium. It is not a passive process but is an active construction and interpretation of experiences. Learning is a ‘treasure within’ and scientific knowledge is being actively built up and constructed by the learners. For constructivists, learning is viewed as an interaction between the learner and the learning environment. During this interaction prior knowledge becomes the root to construct new understanding leading to new innovations and forms the basis for research. In effect, learning is a process in which the learner explores new ideas. Science’s role in improving quality of life is now more prominent than ever.
more prominent than ever. And according to the United Nations Education, Scientific and Cultural Organization (UNESCO, 2007), women's active inclusion and participation in science education is crucial. Encouraging women to take part in science especially in higher education would allow the country to maximize its valuable human assets, empower its women, and improve its economic prospects. But, it is still rare to find women working in scientific fields - and female researchers actively practicing science after obtaining higher education degrees, remain under-represented. According to the UNESCO Institute for Statistics (UIS, 2010) that of the world's total science researchers, only 27 per cent are women. Women and girls still lag behind men and boys in access to basic education in general, and to science learning in particular. Out of all illiterate adults worldwide, two thirds are women. Access to consistent, long-term education, especially in science remains intangible for many girls, so women and girls have to be properly aggravated to attain their basic education. The importance of their role in a nation’s development should be emphasized by involving them in science education.

1.1 Girls Education

Education is an important factor and essential one. Girls' education is very much needed as it is related to the improvement of the society. Girls' are facing many problems in all aspects of life. The educational level is limited to them compared to boys. The technology of education is improved in one side while on the other side girls education is limited. They are not allowed to go for higher education even their performance is good. The relationship between education and sustainable development is complex. Generally, education is the key to a nation's ability to develop and achieve sustainability targets. Education can improve agricultural productivity, enhance the status of women, reduce population growth rates, enhance environmental protection, and generally raise the standard of living. But the relationship is not linear. Education benefits a woman in life-altering ways. An educated woman gains higher status and an enhanced sense of efficacy. Girls education profoundly changes their lives, how they interact with society, and their economic status. Educating women creates more equitable lives for women and their families and increases their ability to participate in community decision making and work toward achieving local sustainability goals.

1.2 Science Education

An important trend in science education is that, science is becoming increasingly complex and abstract. Hence emphasis should be laid from the earliest stage of science education on the proper understanding of the basic principles and the process of scientific abstraction and creative thinking. Teaching and learning of science need to be characterized by focusing emphasis on processes like observation, classification, inference, prediction, hypothesizing, interpreting data, and experimentartion. Science learning should emphasis on learners to relate and understand their surrounding environment. A closer look at the science education curriculum in India can find that, the application of scientific knowledge is virtually non-existent. Instruction in science should foster understanding of scientific facts and ideas to apply in real life situations. In short, the emphasis on science instruction must be for helping students to acquire the scientific knowledge and cultivate scientific attitudes. The challenge is to raise the girls education levels especially in the field of science and technology. Meeting this challenge depends on reorienting science curriculum to address the need of the society and proper guidance and counseling for the parents of girls to motivate and increase the enrollment ratio of girls in science at higher education level.
2. Gender Barriers in Science Education

According to the Sergeant report, “the present stage of our social evolution, there is no special justification to deal with women’s education separately. Every type of education open to men should also be open to women”. The barriers in science at the higher education for the girls were given below.

[1] Poverty and Family Environment

According to the United Nations Millennium Development Goals Report 2010, poverty puts girls at a distinct disadvantage in terms of education. Girls after completing their school education they have been forced to be at home mainly because of the poverty. Their parents treat them as the care takers of their younger ones at home and for assisting them in household works. So even many girls who are higher achievers in science and technology they were not given the opportunity to continue their higher education.

[2] Early marriages

India has its own tradition and culture. Early marriage is also a traditional practice still prevailing in some parts of India where the girls will get married at their early ages while doing under graduate or higher secondary schooling. This will make the girls to be a dropout in the higher education sector. This also causes the poor enrolment of girls in higher education level particularly in science education.

[3] Safety

The parents of the girl children are more concerned about girls’ safety which limits their involvement in activities of development. Due to this barrier, girls will not be allowed to continue their studies especially in science education which involves more field and laboratory work.

[4] School Environment and Infrastructure Facilities

Learning environment and the infrastructure facilities in the schools are contributing more for motivating the students. Schools should promote a friendly and healthy environment to both boys and girls. Inspirational gender equality should be made essential to the access of more girls’ enrolment in higher education in science.

[5] Flexibility in career and work balance

The girls pursuing higher education has the responsibilities both at home and at the workplace. It is quite a difficult job for a girl to concentrate on these two extremes, so many of them are being compelled to leave their higher education and to continue with their household works.

3. Present Scenario of Girls enrolment in Higher Education

According to the UNESCO Institute for Statistics report 2005, in most countries, men predominate in science and engineering (S&E) across all levels of higher education and in research positions. This has been represented graphically in the Figure 1. From the figure it very clear that the enrolment of the girls in all the stages (first degree enrolment, first degree graduates, second degree graduates, Ph.D graduates and researchers) of higher education is found to be less when compared with the boys enrolment. The figure 2 represents the global scenario of girls enrolment ratio in all the fields of study of higher education. In this also the male predominant the girls in all the fields.
Figure 3.1: Comparison of Male & Female Enrollments during various degrees program

Figure 3.2: The global scenario of girls enrolment ratio in all the fields of study of higher education

Source: UNESCO Institute for Statistics 2005

Figure 3.3 - University Enrolment in 2005-06 (Percentage): UGC
In India, according to the Government of India Statistics, the girls enrolment was found to be 41.40 percent and in professional course it is only 14.72 percent. The following figure 3 depicts the details of the gender wise enrollment in the Indian Universities in all the fields of study during the period of 2005-06.

According to the Report of Department of Science and Technology’s National Task Force for Women in Science, the girl’s enrolment ratio was found to be 20 percent lower than that of men in university level enrolment. This report also highlights the enrolment of girls in the field of science, technology and engineering is found to be low whereas the enrolment of girls is quite high in the fields of arts and management courses. In the work field of scientists in Government of Indian Scientific Institutions is represented in the figure 4, which shows the percentage of both the male and female scientists working in senior and junior ranks in the service.

This is also an evident that the percentages of women scientists in both the senior and junior ranks are very meagre, due to the very poor enrolment of girls in the field of science and technology in the higher education. In tradition, the women in India were expected to be home makers and caretakers rather than scientists and professionals; this negative perception hinders the motivation and the interest of women in pursuing science courses in higher education.

4. Promoting Gender Equality

The National Women’s Education Centre (NWEC) an initiative of the Government of India, is to promote women’s education and contribute to realize the gender equal society through conducting training programs for regional government officers, educational and group leaders and international trainees are conducting specialized research and surveys on women’s education. Apart from this, through teaching also should address the common misconceptions about learning science and it should motivate the research spirit among the girls. Mentoring and guiding aspiring researchers is another powerful way to inspire women to stay in the field of science and technology. Role models and mentors must provide objective counseling and help a young woman scientist with her career choices and chances so that more number of women scientists will emerge
in India. Here are some of the strategies through which the gender equality is promoted to enhance the enrolment of girls in science subjects at the higher education level.

![Figure 4.1. Strategies for promoting gender equality](image)

5. Conclusion

Indian women are qualified, accomplished, and ready to overcome barriers. The challenge of them is to find a way to go through open doors by staying committed to the quality of science education and research. Particularly the women in science education should feel empowered to gain access and find opportunities. And also the interest of the women should be enhanced by creating a national web portal to give suggestions and directions to the women regarding the policies and strategy for young women interested in science programmes as well as current women scientists. Government of India takes the priority in women empowerment especially in the field of science, which is evident from the various schemes and programmes for promoting science at higher education. The interest of the girl students in learning science could be made stronger by proper role models in the field and media partnerships are also required to develop the spirit of learning of science among younger students.

References

[6] Website for Indian women in science: www.indianwomenscientists.in