



STEM EDUCATION: AN EMPOWERING STRATEGY FOR WOMEN-A REVIEW

Dr.P.Usha¹ & Prof. Sure Pulla Rao²

¹Assistant Professor , Centre for Women's Studies, College of Arts and Commerce, Andhra University
Visakhapatnam, Andhra Pradesh

²Professor & Head , Department of Economics, College of Arts and Commerce, Andhra University,
Visakhapatnam, Andhra Pradesh

Abstract

Higher education is the threshold for economic empowerment of women which provides employment opportunities and financial stability. Though women constitute half of the total population of the country, their contribution to economic productivity is less than half of the economically active population. This article examines the enrollment of women in higher education in general and Science, Technology, Engineering, Mathematics (STEM) education in particular. The paper aims to identify the factors which discourages women to go for higher education before New Educational Policy and highlights the need for STEM education to meet the current requirements for STEM workforce participation. The gender-responsive enrollment of women in STEM courses demonstrates how these courses would help to meet the Sustainable Development Goals (SDGs) which call for inclusive, egalitarian, high-quality education and opportunities for lifelong learning for all and enforces gender equality.

Key Words: *Economic empowerment, financial stability, economic productivity, New Education Policy, STEM education, Sustainable Development Goals*

Introduction

The National Education Policy 2020 which aims to support the advancement of STEM education in India places a strong emphasis in integrating Science, Technology, Engineering and Mathematics (STEM) education into the curriculum in order to develop students' innovative and critical thinking, and problem-solving abilities. UNESCO recognizes the STEM education and STEM fields which are considered an imperative part of competency-based curricula and given importance from the school level education to higher level education. The gender-responsive enrollment of women in STEM courses demonstrates how these courses would help to meet the Sustainable Development Goals (SDGs) which call for inclusive, egalitarian, high-quality education and opportunities for lifelong learning for all. Rapid advancements in technology evolving students' learning, networks and interactions in order to meet global requirements. The STEM disciplines which are being incorporated for the development of creative and innovative solutions to global challenges would meet the current demand for global workforce. Diversification in STEM education in relevance to gender has a great impact on developing nations which leads to diversion of human resource

for economic growth, technological advancement and societal well-being. When countries invest on their human capital by giving emphasis in encouraging women's participation in STEM education, it helps to foster innovation and address global challenges.

The STEM educational strategy which was adopted in our country in accordance with the new education policy develop the skills of the students in building independent thinking, problem solving skills, and critical analysis and also encourage to take initiative and team work. It also improves communication of the students and promotes digital literacy. (Juditha Hellenin, 2024). According to the report of Financial Express (2024) in India the retention rate of women in online STEM courses, stands at 62%. And Online STEM education sees 12% surge in female enrollment in 2023-24. The UGC reported that 40% women enrolment in STEM field a world record for India (UGC Chairman, Hindu Bureau 2024).

University Grants Commission (UGC) chairperson M Jagadesh Kumar highlights that there is a significant paradigm shift in access to higher education for female students because of the Indian education system which aims to empower women to create their own paths in their career journey. He opined that initiatives like targeted scholarships, girls' hostels, and flexible learning options have undoubtedly played a crucial role in promoting this environment of inclusivity. (The Hindu Bureau, Coimbatore, 2024)

The report of Financial Express (2024) rightly pointed out that the impact of online STEM education in narrowing the gender gap in traditionally male-dominated fields. By offering greater accessibility, networking opportunities, and flexibility in learning, online STEM programs are paving the way for more women to enter and thrive in industries.

Aim

The present paper aims to identify the factors which discourage women to go for higher education before New Educational Policy and highlights the need for STEM education which has given much preference in New Educational Policy in order to meet the current requirements for STEM workforce participation.

Objectives

- 1) To examine the enrollment of women in higher education in general and Science, Technology, Engineering, Mathematics (STEM) education in particular.
- 2) To know how best the premier educational institutions encouraging women to enroll in STEM education.
- 3) To make recommendations for mitigating the detrimental effects of gender on women's enrollment in STEM programmes and involvement in the STEM sector.

Research Methodology

The present paper is mainly a review article based on the secondary data obtained from various journals in websites and published reports of Public Information Bureau.

Literature Review

An overview of the earlier research studies on STEM education gives the overall status of women enrollment in higher and STEM education in India and Andhra Pradesh. The literature review covers the status of women education and the need for women participation in STEM education. Dr. Rita Ghosh Guin (2020) in his study on "*Higher education and women's contribution to regional development*" referred the report of India Survey of Higher Education which revealed that in the last seven years the number of women enrolling themselves for Higher Education in India has risen. The study quoted that Uttar Pradesh, Maharashtra, Karnataka, Rajasthan, Tamil Nadu and Andhra Pradesh constitute nearly 54% of the total student enrolment in India and female students in these six states is almost 54.4% of the total female students enrolled across India. Sanghita Gosh and Amit Kundu (2021) in their article on "*Women's Participation in Higher Education in India: An Analysis Across Major States*", examined the participation

levels of women in higher education across major Indian states and explored the underlying factors in the disparity between states. And found that in 16 major states they perform poorly in post graduation and technical education courses. However, they are better placed in Genuine Progress Indicator (GPI) at under graduation level. It is found that significant share of female teachers, higher per capita state domestic product and availability of colleges and girls' hostels are playing important roles to contributing to the GER of females and GPI in higher

education in India. *Juditha Hellenin* (2024) in her article on “*STEM Education curriculum*” emphasized that our knowledge-based economy is driven by constant innovation. The foundation of innovation lies in a dynamic, motivated and well-educated workforce equipped with STEM skills. It is necessary, therefore, to determine the shortcomings of traditional programs to ensure that new STEM-focused initiatives are intentionally planned. *Shilpa Singhal* (2023) in her article on “*Gender equality and financial inclusion can reduce gender gaps*” highlighted that Ed-tech has the promise of helping traditionally underserved girls and women of India to pursue Science, Technology, Engineering and Mathematics (STEM) education, leading to far better career options for them. She opined that a lot of work remains to be done to encourage girls to pursue STEM fields. She referred the Government initiation of two flagship schemes viz., Vigyan Prasar which aims at practice of science and technology and implications for development and quality of life. And Vigyan Jyothi aims to bridge the gender gap in STEM, empowering women to excel in scientific fields. *Sayak Sinha* (2024) in his article on “*Achieving Gender Equality in STEM: Towards an Inclusive and Diverse Ecosystem*” emphasized that the fields of Science, Technology, Engineering and Mathematics, referred together as STEM, are crucial to a nation's economic prosperity and global competitiveness. Prioritizing STEM education can lead to creation of new technologies and industries, sustainable solutions to climate challenges and greater participation in the global economy. As STEM fields have been historically dominated by men, promoting gender diversity holds the key to creativity, innovation, and harnessing the full potential of the human capital of an economy. The author opined that one major factor for dropping out women from STEM education is the gendering of science and technology, which makes these fields deem suitable only for men. The report of *SME Street Edit Desk* (2023) rightly pointed out that the Institutes of Technology (IITs), National Institutes of Technology (NITs) have introduced supernumerary seats to amplify the involvement of women in these institutions and consequently, in STEM fields at Under graduation level. The positive outcomes of these efforts are evident in the enrollment statistics: the percentage of female students enrolling in B.Tech programmes at IITs has surged from 8% in 2016 to 20% in 2021. Similarly, “NITs have also experienced a significant rise, with female enrollment increasing from 14% in the academic year 2017-18 to 22.12% in 2022-23. *Sunaina Kumar* (2024) in her study on “*Women and Stem: The inexplicable gap between education and workforce participation*” opined that the underrepresentation of women and girls in STEM has been an ongoing concern for policymakers in India. The researcher quoted the gender inequality in STEM which has been addressed in several intergovernmental forums, starting with the Beijing Declaration by the United Nations. She referred the National assessments which have been undertaken to identify the reasons for the lower participation of women and found that India has 18.6 percent of women researchers in R&D activities and attributed the lower participation to familial responsibility faced by women which leads to career breaks and prolonged absence from work. *Fareeha Iftikhar*, (2024) in her article on “*Women enrollment in higher education*” quoted the statement of *Sonal Kapoor*, founder director, *Protsahan India Foundation*, a non-governmental organization (NGO) that the more young women embracing STEM disciplines in higher education, signaling a trend towards gender inclusivity in traditionally male-dominated fields. And he strongly believed that the true measure of progress lies not only in enrollment numbers but also in the translation of these educational achievements into meaningful career opportunities and economic independence for young women.

To sum up, in the last seven years the number of women enrolling themselves for Higher Education in India has risen. Andhra Pradesh constitutes nearly 54% of the total student enrolment in India (*Dr. Rita Ghosh Guin*, 2020). The participation levels of women in higher education across major Indian states and explored the underlying factors in the disparity between states. Female teachers, higher per capita

state domestic product and availability of colleges and girls' hostels are playing important roles to contributing to the GER of females and GPI in higher education in India. (Sanghita Gosh and Amit Kundu, 2021). The reasons for the lower participation of women researchers in R&D activities and attributed the lower participation to familial responsibility faced by women which leads to career breaks and prolonged absence from work. (Sunaina Kumar (2024). One of the major factors for dropping out women from STEM education is the gendering of science and technology, which makes these fields deem suitable only for men. (Sayak Sinha, 2024). The progress of the country lies not only in mere increase in the rate of enrollment but also depends on educational achievements and gaining career opportunities which gives economic independence for young women. (Sonal Kapoor, 2024). Hence, it is essential to identify the drawbacks of traditional methods which ensures the aim of new STEM initiatives. (Juditha Hellenin, 2024).

Trends in the enrollment of Women in Higher and STEM education

The statistical data pertaining to the enrolment of students of different categories and gender shows that there was a significant rise in enrollment of students in higher education. In Andhra Pradesh it was recorded that 19, 87,618 enrolments into higher education in 2020-21, which was 17, 67,086 in 2014-15. The overall increase in enrollment of students in higher education in the state of Andhra Pradesh reports a 12.5% in 2020–21. According to the survey, there is a nationwide increase in the enrollment of Scheduled Castes (SC) by 28% from 46.06 lakh in 2014-15 to 58.94 lakh in 2020-21. The enrolment of SC students is 66.23 lakh in 2021-22 as compared to 46.07lakh in 2014-15 (an increase of 44%). More specifically, female enrolment in higher education in AP increased to 9, 31,553 in 2020-21 from 7, 73,650 in 2014-15, an increase of 20.4%. The Female enrolment has increased to 2.07 crore in 2021-22 from 2.01 crore in 2020-21. Enrolment of Other Backward Caste (OBCs) students in the country increased to 1.48 crore, up from 1.13 crore in 2014-15, indicating a rise of 32%. Female enrollment in tertiary education i.e. both graduation and post graduation has increased from 23% in 2012 to 36% in 2020. (All India Survey in Higher Education, 2022). Over the past decade, there has been a surge in the enrolment of female students in higher education from 1.57 crore to 2.07 crore. The number of females securing Ph.D degrees has gone up by 107 % (The Hindu Bureau, 2024). Female enrolment in higher education has gone up by 28% in ten years. In STEM courses, girls and women constitute 43% of enrolment - one of the highest in the world. (Ministry of Finance, 2024)

The British Council (Nov.2021) Analyses the factors impacting gender parity in higher education in Andhra Pradesh during the period 2011-12 to 2018-19 stated that increased costs of higher education, perceptions about higher education which does not necessarily provide good employment opportunities, lack of motivation towards continuing education among youth in addition to the challenges with medium of instruction, English at higher education level which negatively impact more on girls. And it also found gender disparity in choice of courses in higher education which are influenced by social construct of masculinities and femininities.

India has the highest number of STEM graduates in the world, and the number of women choosing STEM courses has been steadily increasing, even though India lags in women's participation in the STEM workforce. (Sunaina Kumar , 2024) The continuous efforts of Government for encouraging women for higher education have brought drastic changes in their enrollment both in higher as well as in STEM education. Compared to national average of 32%, nearly 70% of Andhra Pradesh's students are enrolled in STEM programmes which places AP second among all 26 surveyed states in terms of STEM enrollment (ToI, Economic Times, 2024)

Government Initiatives to Encourage Women to Enroll in STEM Courses

The Government has been taken initiatives to Promote Women Participation in STEM education by initiating the Schemes such as Vigyan Jyoti Scheme launched by the Department of Science & Technology (DST) which aims to encourage the meritorious girls in high school to pursue Science, Technology, Engineering, and Mathematics (STEM) in their higher education and also facilitate exposure for girl students who have rural background and help them to plan their career as per their choice in the field of science. The Gender Advancement for Transforming Institutions (GATI) will create a thorough Charter and a framework to evaluate Gender parity in STEM. Another scheme is Knowledge Involvement Research Advancement through Nurturing (KIRAN) in order to provide opportunities for women scientists in moving up the academic and administrative ladder. One of the programmes under the KIRAN scheme is 'Women Scientist Scheme' which provides career opportunities to unemployed women scientists and technologists, especially those who had a break in their career. (Source: PIB)

The Ministry of Education (MoE) has launched the SWAYAM initiative, boasting the creation of more than 1,700 courses in the STEM disciplines. A number of initiatives have been implemented by the Ministry of Education to encourage the expansion of STEM courses through Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) and developed over 1,700 STEM courses on this platform. A wide range of subjects are covered in these courses, including technical topics and multidisciplinary fields like data science, artificial intelligence, and machine learning. And also initiated Virtual Labs where web enabled experiments in STEM fields have been developed (Syed Wahab, *Financial Express*, 2023). Women comprised 29.2 percent of the STEM workforce in 146 nations and women made up 49.3 percent of the total employment across non-STEM occupations (Global Gender Gap Report, 2023), the data found that compared to their male counterparts, women who study STEM subjects are less likely to pursue STEM jobs and to leave them earlier. Despite the high proportion of female STEM graduates, women account for less than a third of the STEM workforce in India at 27 percent. (World Bank Report, 2023)

Encouraging women to excel in STEM fields is equally vital. The STEM framework should be the focal point of a redesign of the educational and hiring procedures, and curricula should be updated to incorporate problem-solving skills, critical thinking, a scientific temperament, and an aptitude for creativity and invention. It is imperative to present STEM as a mindset to girls, rather than merely subjects that require instruction, in order to empower them to take on leadership roles and stake their claim in the future. (Shilpa Singhal, 2023).

Conclusion

Rapid advancements in technology evolve students' learning, networks and interactions in order to meet global requirements. Despite of continuous efforts for involving students in accordance of growing demand in such disciplines, there is still a big gap between demand for skilled professionals in various fields. The increase in number of enrollment in STEM education is not reflecting the same in the STEM workforce participation. The studies reveal that women who are obtaining STEM education do not get into the STEM workforce participation in the same proportion due to various reasons especially immobility, traditional gender roles which reflects in the persistence of 'Glass Ceiling'. This pattern demonstrates a sharp decline in educational attainment before entering the workforce, suggesting that women have ongoing obstacles while trying to get work in STEM fields. There is a need for change in the child socialization process which shapes the choices for careers irrespective of gender.

References:

- 1) ‘Surge in higher education ‘ Express News Service, 31 Mar 2023
<https://www.newindianexpress.com>
- 2) All-India Survey on Higher Education (AISHE), 2022.
- 3) Girls outnumber boys in post-graduate courses in Andhra Pradesh, Times of India, TNN/Mar9,2023
- 4) Dr. Rita Ghosh Guin (2020) : “Higher education and women’s contribution to regional development”
© 2020 IJCRT | Volume 8, Issue 5 May 2020 | ISSN: 2320-2882
- 5) Juditha Hellenin (2024) “STEM Education curriculum”
- 6) Sanghita Gosh and Amit Kundu (2021) “Women’s Participation in Higher Education in India: An Analysis Across Major States, <https://www.researchgate.net/publication/353408669>
- 7) <https://www.financialexpress.com/jobs-career/education-online-stem-education-sees-12-surge-in-female-enrollment-in-2023-24-college-vidya-studynbsp-3415550/>
- 8) SME Street Edit Desk Report (2023) “Government Initiatives to Foster Women's Participation in STEM Courses” <https://smestreet.in/limehighlight/government-initiatives-to-foster-womens-participation-in-stem-courses-2022164> 13 Dec 2023 16:31 IST.
- 9) <https://education.economictimes.indiatimes.com/tag/Andhra+pradesh>
- 10) Report of PIB on “Women Participation in Science, Technology, Engineering and Mathematics (STEM)”
- 11) <https://www.financialexpress.com/jobs-career/education-stem-enrollment-of-female-students-surges-to-4-5-at-heis-says-mos-education-subhas-sarkar-3209732/>
- 12) <https://www.orfonline.org/expert-speak/women-and-stem-the-inexplicable-gap-between-education-and-workforce-participation>
- 13) Sunaina Kumar (2024) :“Women and Stem: The inexplicable gap between education and workforce participation” Observer Research Foundation Jan 24th 2024
- 14) <https://www.hindustantimes.com/ht-insight/gender-equality/financial-inclusion-can-reduce-gender-gaps-in-india-101712317785457.html>.
- 15) <https://www.hindustantimes.com/education/news/women-comprises-48-of-overall-enrollment-in-higher-education-aishe-report-101706323112640.html>.
- 16) Fareeha Iftikhar, (2024) “Women enrollment in higher education” Hindusthan Times, New Delhi Jan 27, 2024 08:21 AM IST

