

Gender Disparities in Engineering and Technical Education in India: A Review

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Abstract

Education plays a crucial role in the socio-economic development of a country. It contributes significantly to human development by reducing poverty, ignorance, and social exclusion. Ensuring equitable access to education for all sections of society, particularly marginalized groups, is essential for inclusive growth. After elementary and secondary education, technical education becomes a key driver of skill development, employability, and national productivity.

In India, women constitute nearly half of the total population; however, their enrolment in technical education remains significantly lower than that of men. This persistent gender gap in technical education is a matter of serious concern and reflects broader socio-economic and cultural constraints. The present study analyzes the trends in female enrolment in diploma and degree-level engineering education in India using secondary data from national sources. The paper also examines branch-wise gender participation and identifies key factors influencing disciplinary choices. Based on the findings, the study proposes policy-oriented suggestions to reduce the gender gap and promote women's participation in higher technical education.

Keywords: Technical education, Female enrolment, Gender gap, Engineering education, India

1. Introduction

The development of a nation is closely linked to the growth and quality of education within its society. Education is the primary instrument for creating skilled, responsible, and resourceful citizens who contribute to economic productivity and social progress. While elementary education provides a foundational base, technical education plays a vital role in enhancing human intelligence, decision-making ability, planning, management skills, and technological competence.

In the twenty-first century, technical education is widely recognized as a powerful instrument for socio-economic development. It contributes significantly to industrial growth, innovation, and employment generation. Importantly, it also serves as a means of empowering marginalized sections of society, particularly women.

Women are central to social development, as they influence family well-being and the education of future generations. As emphasized by Swami Vivekananda, "*Women must be educated, for it is the women who mould the next generation and hence the destiny of the country.*" Despite this recognition, women continue to face limited access to higher technical education in India. According to census and national education data, women constitute nearly half of the population, yet their participation in engineering and technical education remains disproportionately low.

The present study examines trends in female enrolment in polytechnic and undergraduate engineering programs in India. It highlights gender-wise and discipline-wise participation and proposes recommendations to reduce the gender gap in higher technical education.

2. Objectives of the Study

The objectives of the present study are:

1. To identify year-wise establishment and expansion of polytechnic and degree engineering institutions in India.
2. To analyze year-wise female enrolment in relation to total enrolment in polytechnic and engineering institutions.
3. To examine gender-wise enrolment across major engineering disciplines.
4. To suggest suitable measures to reduce the gender gap in higher technical education in India.

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3. Methodology

The study follows a descriptive research design based on secondary data. Data and information have been collected from the All India Survey on Higher Education (AISHE), government reports, research articles, research journals, and e-journals. The analysis is limited to officially reported national-level statistics for selected academic years.

4. Technical Education for Girls in India

India possesses one of the largest technical education systems in the world, comprising polytechnics, engineering colleges, technical universities, institutions of national importance (such as IITs, NITs, and IISc), and autonomous and deemed universities.

4.1 Polytechnic Education

AISHE data indicate the following trends in female enrolment in polytechnics:

- **2010–11:**
Total enrolment: 1,192,467
Female enrolment: 210,499
- **2011–12:**
Total enrolment: 1,277,468
Female enrolment: 224,604
- **2012–13:**
Total enrolment: 1,371,278
Female enrolment: 238,348
- **2013–14:**
Total enrolment: 12,183,792
Female enrolment: 221,832

Although the absolute number of female students increased during the period, their proportion remained substantially lower than that of male students, indicating a persistent gender gap in diploma-level technical education.

5. Female Enrolment in Undergraduate Engineering Education

At the undergraduate level, engineering and technology programs have witnessed significant expansion. However, female participation has remained below one-third of total enrolment:

- **2010–11:**
Female: 621,090 out of 2,139,491 (29.02%)
- **2011–12:**
Female: 790,965 out of 2,774,828 (28.50%)
- **2012–13:**
Female: 998,974 out of 3,471,488 (28.77%)

These figures show modest growth in absolute numbers but stagnation in proportional representation.

6. Discipline-Wise Gender Participation

The study reveals significant variation in female participation across engineering disciplines:

- **Computer Engineering:** High and increasing female participation (41.09% in 2010–11 to 45.10% in 2012–13)
- **Electronics Engineering:** Moderate and increasing participation (35.55% to 39.17%)
- **Architecture:** Highest female participation (over 51%)
- **Mechanical Engineering:** Very low and declining participation (below 6%)
- **Mining and Marine Engineering:** Extremely low female participation (below 3%)
- **Civil and Electrical Engineering:** Moderate but stagnant participation (around 18–25%)

These trends indicate strong gender-based segmentation of engineering disciplines, with women concentrated in computer-related and design-oriented fields.

7. Factors Influencing Disciplinary Choices

Women's disciplinary choices are influenced by multiple socio-economic and cultural factors, including:

- Parental control over academic decisions
- Perception of marriage as a priority over career
- Financial constraints
- Lack of role models

- Safety, mobility, and social norms
- Perceived suitability of certain disciplines for women

Engineering branches such as mechanical, mining, and marine engineering are often viewed as physically demanding or male-dominated, discouraging female participation.

8. Recent Trends

Recent years have witnessed changing aspirations among young women, with increasing preference for professional and job-oriented courses. Fields such as computer engineering, information technology, and management-related programs have become particularly attractive due to better employment prospects and perceived work-life compatibility.

While this shift reflects growing empowerment, traditional gender segregation across disciplines remains largely unchanged.

9. Conclusion

The study highlights the persistent gender gap in technical education in India, despite overall expansion of engineering and diploma-level institutions. Although female enrolment has increased in absolute terms, proportional representation remains low, particularly in core engineering branches.

There is an urgent need for corrective measures to:

- Increase public awareness regarding the value of educating girls
- Promote gender-sensitive policies in technical institutions
- Provide financial support and scholarships for female students
- Encourage role models and mentorship programs
- Improve safety, infrastructure, and hostel facilities
- Sensitize families and communities, especially in rural areas

Affirmative action and sustained policy interventions are essential to ensure equitable access to technical education for women. Recent trends provide cautious optimism, but substantial efforts are required to translate growth into genuine gender equity.

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