

Women in Technical Academia: Gendered Pathways, Educational Equity, and Professional Experiences of Engineering Faculty in Jaipur City in the Context of NEP 2020 and NCF-SE 2023

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Abstract: *Indian society continues to grapple with traditional gender norms that shape educational and professional opportunities for women. Despite policy frameworks promoting equity, women in technical education often face systemic barriers. This study investigates the educational trajectories, professional experiences, and family dynamics of women engineering faculty in Jaipur City, focusing on how gender mediates access, career progression, and workplace participation. A mixed-methods design was employed, combining surveys, structured interviews, and observations of 100 engineering teachers (50 male, 50 female) across designations. Findings reveal that while women increasingly enter engineering education and teaching, they encounter subtle discrimination, tokenism, and boundary heightening within institutions. Family support emerged as both enabling and constraining, influencing women's career mobility. The study concludes that gender-blind policies alone are insufficient; informal practices and patriarchal expectations continue to shape women's experiences. By foregrounding women's voices, this research contributes to gender studies in technical academia and offers insights for policy reform and institutional sensitization.*

Keywords: Gender, Engineering Education, Women Faculty, Career Pathways, Jaipur, Higher Education

1. Introduction

Gender sensitization refers to modifying behavior and attitudes to promote equity. In India, despite progress in literacy and social development, women remain underrepresented in technical academia. Engineering, traditionally a male-dominated field, continues to reflect structural barriers and cultural biases.

This study explores the lived experiences of women engineering faculty in Jaipur City, examining how education, profession, and family intersect to shape their career trajectories. By situating the research within Biyani Group of Colleges, a private institution with egalitarian policies, the study interrogates whether formal frameworks translate into equitable practice.

The NEP 2020 emphasizes equitable access to technical education and the dismantling of gender stereotypes in STEM disciplines. Similarly, NCF-SE 2023 advocates gender-sensitive pedagogy and institutional reforms to ensure that women faculty and students are not marginalized within male-dominated fields. This study situates itself within these policy frameworks, examining whether institutional practices in Jaipur reflect these national commitments.

2. Literature Review

A number of studies have been conducted on family, education and work of women in a comparative perspective in both the developed and the developing world. Many of them concentrate on the equal access of girls to education, labour force participation rate of women and gender segregation in the labour market. In India as well, studies on education and work are mainly in the areas of opportunities

for women's education and labour market segmentation respectively. Following research studies were analysed to understand in depth the field of study undertaken:

- **Gender and Education:** Studies highlight unequal access and stereotypical expectations (Kaufman, 1984; Keller, 1995).
- **Women in Science & Engineering:** Structural barriers and minority status create hostility (Carter & Kirkup, 1990; Subrahmanyam, 1998).
- **Professional Segregation:** Women cluster in low-status jobs despite higher qualifications (Chanana, 2001).
- **Career Interruptions:** Motherhood and family responsibilities constrain mobility (Caplow, 1954; Elgquist Saltzman, 1992).
- **Indian Context:** Women engineers face placement bias and limited recognition (Parikh & Sukhatme, 1992; Jaiswal, 1988).

Also, the recent policy frameworks such as NEP 2020 and NCF-SE 2023 underscore the importance of integrating gender equity into curriculum design, teacher training, and institutional governance. These policies provide a lens through which the experiences of women engineering faculty can be critically examined.

3. Rationale

As mentioned earlier, there is a scarcity of studies on women professionals in India, especially engineering teachers. Hence it is important to focus the attention on them. This study is done among the selected engineering teachers of the Biyani Group of College Jaipur. The decision to locate the study in Jaipur was taken as it would be interesting to explore the status of women in such a state where from long time and till now females were ranked inferior than males.

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Within Jaipur, Biyani Group of College Jaipur has been selected for the study because it is one of the few organizations in Jaipur where women engineering teachers with many years of work experience are employed. Biyani Group of College Jaipur was of special interest because it is an organization with structured frameworks and policies suited for an egalitarian workplace. Also, it is one of the institutions where both male and female faculties are participating in imparting education to girls. For these reasons it is also a much sought after workplace.

As the seniority and rank at the time of appointment are the only criteria for the promotion of engineering teachers within the organization. Hence such policies are without gender bias and therefore do not give any consideration to the gender of the employees. So ideally the women engineering teachers should be working in the organization just like the men who have been there.

From the in-depth literature review it was found that a few studies focus specifically on women engineering teachers in India, making this research timely and necessary.

Objectives

- 1) To analyze women's access to engineering education and classroom experiences.
- 2) To compare career entry and progression of male and female engineering faculty.
- 3) To examine the role of family in supporting or constraining women's professional lives.
- 4) To assess perceptions of employers and male colleagues regarding women faculty.

4. Methodology

Research Design: This study employed a robust mixed-methods research design, integrating both quantitative and qualitative approaches to comprehensively explore the multifaceted experiences of engineering faculty. The quantitative component consisted of structured surveys aimed at capturing demographic profiles, career progression metrics, and family background variables. Complementing this, qualitative semi-structured interviews provided rich, in-depth insights into participants' perceptions, challenges faced, and their sense of agency within academic and professional contexts. Additionally, direct observations of workplace dynamics and classroom participation were conducted to contextualize and triangulate the data.

Sampling Strategy

A total of 100 engineering faculty members were purposively selected to ensure gender parity and representation across academic designations. The sample comprised an equal number of male and female participants (50 each), drawn through stratified random sampling to reflect diversity in rank, department, and institutional roles. This stratification ensured that findings could be generalized across different strata within the engineering academic community in Jaipur.

Distribution of Engineering Faculty by Designation, Gender, and Age Group (Biyani Group of Colleges, Jaipur)

Table 1: Distributions of Engineering teachers in Various Designations

	Assistant Professors		Associate Professors		Professors		Lab Attendants		H.O.D		Total
Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
26-35	5	18	1	1							25
36-45	8	3	1	4	1	1	2	2			20
46-55	13	6	9	7	4	0	2	1	3	0	45
56-65	3	5	0	2	0	0	0	0	0	0	10
Total	29	32	11	14	5	1	4	3	3	0	100

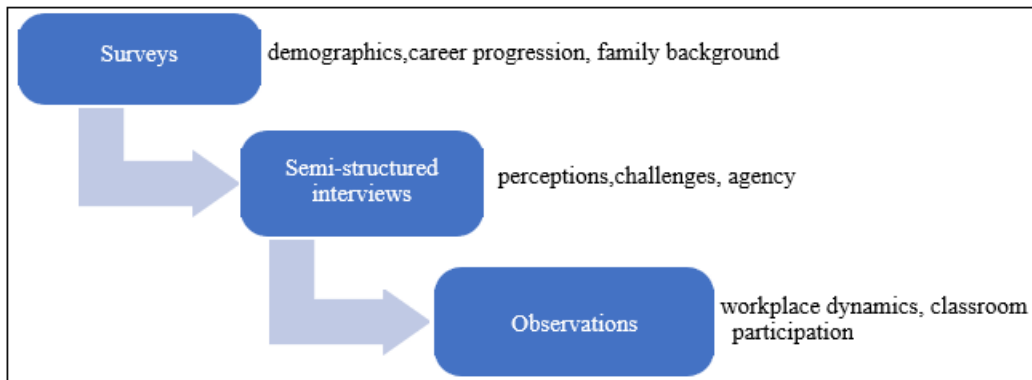
5. Data Collection Methods

Surveys: Standardized questionnaires were administered to collect quantitative data on participants' demographic characteristics, career trajectories, and familial influences. These surveys facilitated statistical analysis of patterns and correlations relevant to gender and professional experiences.

Semi-Structured Interviews: In-depth interviews were conducted using a flexible guide that allowed participants to

elaborate on their lived experiences, perceptions of gendered challenges, and their strategies for navigating institutional barriers. This qualitative method enabled the capture of nuanced narratives that quantitative data alone could not reveal.

Observations: Systematic observations were carried out in workplace settings and classrooms to document interaction patterns, participation dynamics, and informal practices that influence gender relations and professional engagement.



Data Analysis

Quantitative data from surveys were analyzed using descriptive statistics to identify trends and demographic distributions. Qualitative data from interviews and observations underwent thematic coding, employing an iterative process to identify recurrent themes, patterns, and divergences related to gendered experiences in technical academia. The integration of these analytical methods allowed for a comprehensive understanding of the complex interplay between individual agency, institutional structures, and socio-cultural factors affecting women engineering faculty.

Analysis: Thematic coding (qualitative) + descriptive statistics (quantitative).

6. Findings

1) **Educational Access:** Women faculty in technical academia predominantly hailed from families with relatively high educational attainment, which provided a foundational support system for their academic pursuits. However, despite this familial advantage, these women frequently encountered pervasive societal stereotypes from an early age that questioned their suitability for engineering disciplines. These stereotypes manifested in subtle discouragements and gendered expectations that framed engineering as a male domain. The internalization of such biases often influenced women's self-perception and academic confidence, thereby shaping their educational trajectories. This finding aligns with broader literature on gendered educational access, emphasizing the role of socio-cultural factors in mediating women's participation in STEM fields.

Table 2: Rural–Urban Background of Engineering Faculty Respondents

Rural Urban Backgrounds of Engineers			
Locality	Men	Women	Total
Urban	19	21	40
Rural	31	29	60
Total	50	50	100

- 2) **Career Pathways:** The professional trajectories of women engineering faculty revealed a pronounced clustering in junior academic roles, particularly assistant professorships, while senior positions such as Head of Department (HOD) and full professorships remained predominantly occupied by men. This vertical segregation underscores the persistence of tokenism, where women's presence is numerically limited and symbolically constrained within institutions. Boundary heightening practices were evident, with informal networks and institutional cultures reinforcing gendered hierarchies that impede women's upward mobility. These dynamics reflect systemic barriers that extend beyond formal policies, highlighting the need for targeted interventions to dismantle structural inequities in academic career progression.
- 3) **Family Dynamics:** Family emerged as a dual-edged factor in women's professional lives. On one hand, familial support was instrumental in facilitating women's entry into engineering education and subsequent academic careers, providing emotional encouragement and logistical assistance. On the other hand, entrenched traditional expectations regarding women's roles in marriage, motherhood, and domestic responsibilities imposed significant constraints on their career mobility and professional aspirations. These conflicting pressures necessitated complex negotiations by women faculty to balance professional commitments with familial obligations, often resulting in career interruptions or slowed progression. This theme highlights the intersectionality of gender and family in shaping academic careers.

Table 3: Educational Levels of Parents and Siblings of Engineering Faculty Respondents

Educational Levels of Parents and Siblings												
	Men				Women				Total			
	F	M	B	S	F	M	B	S	F	M	B	S
Non literate	3	3	N	N	N	N	N	N	3	3	N	N
Literate	19	24	2	3	10	19	1	0	29	43	3	3
10/+2	15	15	9	11	16	6	4	4	31	21	13	15
Grad/PG (Non-tech./non-Prof)	11	6	14	21	18	14	17	19	29	20	31	40
Grad./ PG (tech./Prof)	2	2	20	7	6	11	20	15	8	13	40	22

N.A.	0	0	5	8	0	0	8	12	0	0	13	20
Total	50	50	50	50	50	50	50	50	100	100	100	100

7. Workplace Perceptions

Within the workplace, perceptions of women engineering faculty were complex and multifaceted. Employers and male colleagues generally recognized and acknowledged the professional competence, dedication, and contributions of women faculty members. However, this acknowledgment was frequently accompanied by persistent stereotypes and biases related to women's marital status, motherhood responsibilities, and assumptions about potential career discontinuity. These stereotypes often manifested as subtle yet impactful barriers, influencing women's opportunities for participation in key decision-making forums, access to professional development, and inclusion in informal networks that facilitate career advancement. The persistence of such gendered assumptions highlights the limitations of formal, gender-neutral policies and underscores the urgent need for institutional cultures that actively challenge these biases and foster genuine inclusivity.

Although Biyani Group of Colleges has adopted egalitarian policies, informal practices continue to disadvantage women faculty. NEP 2020's emphasis on institutional gender inclusion and NCF-SE 2023's call for sensitization committees highlights the need for systemic interventions to bridge this gap. As Table 2 indicates, a majority of women faculty come from rural backgrounds, underscoring NEP 2020's emphasis on bridging rural-urban divides in access to technical education.

8. Limitations

- Focused on one institution in Jaipur; findings may not generalize nationally.
- Sample size limited to 100 respondents.
- Reliance on self-reported data may introduce bias.

9. Research Contribution

This study recommends aligning institutional practices with NEP 2020 and NCF-SE 2023 by establishing gender sensitization cells, embedding gender-sensitive pedagogy into technical curricula, and creating mentorship networks for women faculty. Such measures would strengthen equity in technical academia and ensure that policy commitments translate into lived realities.

This study significantly advances gender studies in technical academia by aligning its contributions with the transformative visions outlined in the National Education Policy (NEP) 2020 and the National Curriculum Framework for School Education (NCF-SE) 2023.

- **Foregrounding Women's Voices:** This research centers the lived experiences of women engineering faculty, thereby addressing the NEP 2020's emphasis on inclusivity and representation of marginalized groups in education. By amplifying these voices, the study challenges dominant narratives and contributes to a more equitable academic discourse, fostering an environment where diverse perspectives are valued and integrated.

- **Policy Insights:** The findings critically demonstrate that gender-blind policies, while well-intentioned, are insufficient without actively addressing the informal practices and cultural norms that perpetuate gender inequities. This insight resonates with NEP 2020's call for gender-sensitive reforms and institutional accountability, urging policymakers and academic institutions to move beyond formal equality towards substantive equity.
- **Pedagogical Relevance:** The study provides robust evidence supporting the integration of gender sensitization into technical education curricula, echoing the NCF-SE 2023's recommendation to embed values of equity, social justice, and gender awareness across educational stages. This pedagogical approach not only enhances students' critical consciousness but also prepares future engineers to contribute to more inclusive and socially responsible technological fields.

Overall, this contribution statement situates the research within the broader national educational reform agenda, highlighting its relevance and potential impact on policy, pedagogy, and academic culture in technical education.

10. Conclusion

Women engineering faculty in Jaipur navigate complex intersections of education, profession, and family. While egalitarian policies exist, patriarchal norms and informal practices continue to shape their experiences. The study underscores the need for gender-sensitive reforms in technical academia, moving beyond access to equity in outcomes.

Future research should expand to multiple institutions, adopt longitudinal designs, and compare across regions to deepen understanding of women's trajectories in engineering education.

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