



BEYOND THE PARADOX:

AN INTERSECTIONAL INEQUALITY AMONG WOMEN IN STEM IN INDIA

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Abstract

India's science, technology, engineering, and mathematics (STEM) environment creates an ongoing contradiction. Despite producing one of the world's largest proportions of women graduates, women still experience significant under-representation in faculty roles, scientific leadership and research. Through a qualitative secondary analysis of pre-existing national data and policy documents, this study examines the 'missing middle' between educational achievement and employment as a way to define systematic exclusion. This research highlights the need for intersectional data frameworks and inclusive policy reform for greater understanding and reduction of inequalities experienced by women working in STEM. Specifically, the data show that women from marginalised castes, rural areas and economically disadvantaged backgrounds experience multiple layers of exclusion. The study calls for an intersectional approach to data collection, performance measures, and a priority for qualitative studies that centre the voices of marginalised women in STEM in India.

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Introduction

In the last two decades, the growth of India's scientific and technological infrastructure has been significant due to the rapid increase of higher education institutions, programmes related to digital skills and investments by the government to encourage innovation. This increase in the number of institutions has led to an increase in the number of women who now have access to a wider range of STEM-related educational opportunities. As per the AISHE 2021 report, women now make up more than 43% of total enrolment in STEM disciplines; which is greater than most of the developed countries. However, although there has been an increase in the number of women participating in STEM programs, the lack of representation of women in the STEM workforce and academic leadership roles is still very much present. As stated in the Women in Science Report by the Dept. of Science and Technology (2020), there are only about 14-16% of women who fill faculty positions in Science and Technology institutions and approximately only a small number of women who are engaged in scientific research. This disparity between women attaining higher education degrees and then entering into jobs in those areas is termed the "Gender Paradox" in STEM.

This contradiction exposes a broader structural issue. The entry of women into STEM Education does not guarantee their inclusion, advancement, and acknowledgment in professional and research spaces (Arredondo et al., 2022). The problems are not just limited to numbers, as many social hierarchies and institutional biases still exist that determine who becomes successful in STEM and under what conditions. Within the social strata of India, caste, socio-economic status, regional differences and urban/rural differences intersect with gender to create different opportunities and exclusion experiences (Niumai, 2025). For example, while a middle-class woman who is an engineering student in an urban private university experiences a very different

environment than a Dalit or tribal woman studying in a rural government college, national statistics generally view “women” as a single, homogenous entity and overlook the many layers of inequality that exist in this population.

The theory of intersectionality, developed by Kimberlé Crenshaw in 1989, is a framework for understanding how various forms of power (i.e., patriarchy, caste, class) overlap and create different ways of experiencing marginalization. This theory has been elaborated upon by authors including Rege (1995) and Banerjee and Ghosh (2019) who argue that gender cannot be understood independently from caste and class, as these social structures work together to define individuals’ access to education, work, and social capital. Additionally, if we use the lens of intersectionality to understand the barriers women face when participating in STEM fields, we realize that these barriers are not homogenous but rather cumulative. Marginalized caste women may simultaneously experience institutional barriers, constraints on financing, and social stigma that make it difficult for them to continue their education or advance in their careers (Pradhan & Jurow, 2025).

Kochupurackal, Margot et al. (2021) have identified the deficiencies of intersectional data within India. For example, the All India Survey on Higher Education (AISHE) provides extensive gender specific and caste specific information. However, it lacks the ability to cross-tabulate both caste and gender categories. Additionally, the Periodic Labor Force Survey (PLFS) provides gender breakout of employment, but does not provide cross-tabulation with other intersectionality variables that could allow for a more nuanced understanding of stereotypes associated with marginalisation (Singh & Sethi, 1991). The Women in Science report, published by the Department of Science and Technology, is one of very few reference documents to include gender equity within STEM and finds that women have low levels of participation; however, it does not document caste or region as an aspect of that data (Gupta, 2020). Therefore, the hurdles that Dalit, Bahujan, Adivasi and rural women have experienced in terms of their inclusion and retention in STEM related fields remain largely unseen in policy and public discourse, the lack of intersectional data will have a substantial impact on the way we develop and implement policy. The aggregate statistics in regard to women’s participation in STEM, will mask those who are at the most disadvantage. Therefore, when policy is created using data that does not reflect the intersectionality of the majority of women, it can only provide minimal solutions for that group (Williams et al., 2018).

As Example; Gender-focused initiatives like “Vigyan Jyoti” or the “Women Scientists Scheme” (WOS) do not necessarily focus on underrepresented communities, instead just focusing on general female representation (Coley et al., 2022). This allows for these programs to unintentionally continue to create new forms of social inequality by simply not acknowledging that there are other groups that are also significantly underrepresented in these areas. The way that higher education is privatized and regionally uneven throughout India has significantly widened the gap. Southern states (particularly Tamil Nadu and Kerala) are experiencing an increased rate of female participation in scientific/technical education than northern and central states; thus showing the presence of larger socioeconomic disparities (Muralidhar & Lakkanna, 2024). Even though there are a plethora of private engineering/technology colleges, they tend to have very few scholarships available and much higher fee structures making them difficult to access for women from economically disadvantaged/marginalized-caste backgrounds; therefore, the reported data indicating that STEM education is providing gender parity does not consider that significant inequities still exist (Pradhan, 2024). This study does not intend to discredit the progress made in women’s STEM education; however, it does intend to reveal the areas of silence and omission regarding the documentation of that progress and its understanding. This entails a qualitative secondary analysis of national reports such as AISHE, PLFS, and DST’s Women in Science; therefore, this research will examine how existing official data systems define and define gender equity within STEM fields, plus what those data systems do not contain.

This study critically analyses the assumptions and perspectives embedded in all of the reports on women in STEM, including the specific categories and voices that were included and excluded. It uses an intersectional feminist lens through which to assess the missing data as evidence that what is not measured can tell us as much as what is. The interpretive approach used in this study is consistent with feminist epistemological traditions that challenge the politics of knowledge production. Feminist scholars have consistently argued that the absence of women of colour and Indigenous people from dataset is not by accident, but rather indicative of much larger epistemic hierarchies. In the context of women’s participation in Indian STEM, Amirtham and Kumar (2023) demonstrate how the institutional culture creates hierarchies where certain types of merit are privileged through an English-speaking academic network in urban areas, thus perpetuating systemic disadvantage for rural, caste-marginalised women.

Review of Literature

Notably, the study of the inclusion of women within the fields of science, technology, engineering, and mathematics commonly abbreviated to STEM within the context of the nation of India has developed across several different stages of inquiry, with the initial focus involving the more descriptive statistics of the female-to-male figures of enrollment within these disciplines. Yet one specific aspect of the study of these issues is clear within the body of most, if not all, of the current literature on the topic of the inclusion of women within STEM-based disciplines within the nation of India specifically the so-called “gender paradox.”

In the All India Survey on Higher Education, 2023, the percentage of women as a part of the total enrollments in the STEM fields of higher education across India is over 43%, making India one of the world leaders in terms of the participation of females in the fields of science and engineering education. Even in the area of education, the performance of India in the academic sphere contrasts starkly with the poor representation of females in the area of the STEM workforce. Women in the scientific fields make

merely 14% to 16% of the scientific workforce as faculty, whereas technology institutions and less than 18 percent of the total scientific workforce in government-funded research organizations (Department of Science and Technology, 2020).

Dasgupta/Sharma (2021) have termed this mechanism of the decline of the participation of women as the “leaky pipeline” where the participation of girls decreases at every phase of their career from being students in postgraduation to being employees in research. There can be several reasons behind the decline of the participation of girls, like their social obligations towards their families.

The focus of the AISHE and the Periodic Labour Force Survey (PLFS) has been on overall gender ratios and ratios without showing the complex nature of inequality. In a recent article in the Economic and Political Weekly, Gupta and Banerjee (2020) argue that when gender and caste are treated distinctively instead of in an intersectional way, statistically marginalised women remain invisible. This is an important change in gender and STEM fields of study in India from quantification of participation to an examination of how participation is quantified.

On the part of Kimberlé Crenshaw, in 1989, Kimberlé made a significant note that introduced the use of a perspective that could define the compound inclusion that occurs as a result of social identity categories such as gender, caste, and class. Indian feminist thinkers such as Rege (2013), Guru, et al. (2011).

In STEM research, intersectional approaches remain scanty but increasingly recognized as crucial. The UNESCO Science Report of 2021 mentions that the Indian gender equality policies in science seldom engage with caste-based disparities (UNESCO 2021). According to Research Matters (2023), a study undertaken by the Indian Institute of Science reported persistent caste-based underrepresentation in elite science and engineering programs. Women from Scheduled Castes and Scheduled Tribes remain concentrated in lower-tier institutions, while high-ranking technology institutes continue to reflect upper-caste dominance.

This is supported by the Women in Science Initiative of the Indian Academy of Sciences, 2021, that argues for the need to collate data disaggregated by gender, social group, and region. In the absence of such data, policies and programs aimed at promoting gender equality tend to perpetuate elite, urban, upper-caste women, thereby leaving out their rural or lower-caste counterparts.

There is also an increasingly visible body of research which contests the manner in which the very framework of ‘data’ also reifies exclusion. Arguments made by feminist epistemology position the production of ‘data’ as reifying the existing hierarchy in which they were produced (Harding, 1991; Haraway, 1988). In the context of India’s STEM field, the absence of ‘intersectional’ identities from official records is not just the failure of the framework to account for these nuances, but also the hierarchy of those whose experiences were considered worthy of measurement.

Gupta and Banerjee (2020) have referred to this tendency as the issue of “data invisibility” wherein the tendency to exclude persists unnoticed. From a qualitative position, such absences themselves constitute data as evidence of neglect. The very DST Women in Science Report (2020) itself concedes that although the numbers in R&D are growing for women, there are no mechanisms to record or analyze career progress in different disciplines or at different regional levels (Department of Science and Technology, 2020).

Thus, the hard-core institutional and deep-rooted cultural norms are still major barriers toward women’s retention in STEM. According to the UNESCO Science Report (2021), women’s career progression in science faces strong family expectations, inadequate childcare facilities, and inflexible working environments. Women scientists experience implicit bias when being assessed for recruitment and promotion which limits their ability to achieve research-related roles as opposed to expected channels towards teaching or admin positions. Language and Class Hierarchies add additional complexity in terms of barriers; English-Medium courses at Universities favour Urban Upper Class Women who go through Elite Education Systems versus other Women who are usually from Vernacular Educational Systems. Rege (2013) and Guru (2011) have stated that there is a direct correlation between caste hierarchies that exist within Indian society and knowledge generation within India. The Women coming from Marginal Backgrounds are doubly disadvantaged by both Material and Epistemological Exclusion from the Mainstream Spaces of STEM and the Regional Asymmetry further complicates Gender Equity within STEM. For instance, southern states like Kerala, Tamil Nadu, and Karnataka have greater female representation in science and engineering than northern and central states, where educational infrastructure and literacy levels remain relatively lower.

The privatization trend in the field of higher education in our country has certainly enhanced access to these institutions; however, at the same time, it will also create a wider socioeconomic gap between different sections of people. For private engineering and technology colleges, the fees tend to be more and the number of scholarships is very low; hence, access for weaker economic sections is also very low, particularly for women belonging to weaker castes. The DST Women in Science Report 2020 and UNESCO 2021 have both highlighted how the factor of affordability and the nature of institutions play an important role in access to computer science and engineering courses, which can be considered to be at a very high technology level.

The state schemes like Vigyan Jyoti and the Women Scientists Scheme (WOS) have been designed to increase the level of gender inclusion in the field of science by facilitating women’s re-entries into research activities, as well as the involvement of girls in STEM-related professions. According to UNESCO Science Report (2021), these schemes rarely address issues like caste- or region-based disparities. The evaluation results have revealed that these schemes are only accessible to “urban”.

While India has made gains in the quantitative involvement of females in the Science, Technology, Engineering, and Mathematics fields, it has failed to make similar gains in the qualitative. India is deeply affected by caste, class, and regional factors regarding females in Science, Technology, Engineering, and Mathematics, which, at a statutory level, have shown a

phenomenon of ignoring these factors in relation to gender. This leads us to the situation of “data invisibility” where females are invisible, not due to their nonexistence, but due to the non-measurement of them. It is the background for the present study, which observed the very absence as a factor of inequality through the lens of secondary qualitative interpretability.

Research Gap

While researchers have documented a significant gain in women’s participation (in science, technology, and other related areas); the overall body of work regarding gender equity for women in Indian STEM has been largely limited by an absence of “intersectional evidence.” The majority of this data has been generated from broad-based national surveys (such as the All India Survey of Higher Education, and the Periodic Labor Force Survey 2023), which have provided an overview of women’s participation across several different areas, but no systematic, quantitative evaluations of women’s participation have considered intersectionality, such as caste, socio-economic status, rural or urban location, and type of institution. This lack of intersectional evidence has had a particular impact on groups of women most likely to be marginalised; therefore, there is a clear absence of any research-based, evidence-supported database for policy purposes. Gupta & Banerjee (2020), as well as papers presented to the DST in 2020 presented the same limited methodology in that they only focused on how to increase the total number of women in STEM areas, and there is no any data-based evaluations about the qualitative differences of women’s experiences in these areas. Evidence from the same body of research by region or area has indicated that this need has not been addressed in existing studies; an area that was particularly neglected in both of the papers presented to UNESCO in 2021. Thus there is a need for a qualitative, interpretive study that re-examines official data and policy documents not only for what they reveal but also for what they omit. This research aims to address that gap by interpreting missing or partial data as evidence of deeper structural exclusion within India’s STEM ecosystem.

Objectives

1. To identify gaps in intersectional representation within national STEM data systems.
2. To examine how limited data frameworks obscure marginalized women’s experiences.
3. To explore institutional and regional factors affecting women’s participation in STEM.
4. To propose an intersectional approach for inclusive STEM policy development in India.

Methodology

The qualitative research design of this research is based on qualitative research using Secondary Data Analysis methodologies. This methodology involves using and analysing existing National datasets and National policy documentation that is available to the public. This is intended to identify the nature of omissions and structural limitations in these documents and datasets. The main datasets that have been analysed in this research include the All India Survey on Higher Education (AISHE) 2020-21, Periodic Labour Force Survey (PLFS) 2022-23 and the Women in Science Reports(2020) produced by the Department of Science and Technology, and any other Policy Briefs published by UNESCO(2021). The analysis procedure will be structured using an intersectionality approach based on Feminism Perspective and will use a thematic qualitative approach to define the existing dimensions of array of Official Data without producing or creating new clusters of numerical data. The primary datasets that were used to code data include the themes: 1) Thematic Coding - Gender representation 2) Data Invisibility 3) Policy omission 4) Intersectional Exclusion 5) Gender-4STEM Increasing Women Participation in STEM areas Still Needs Attention to Systemic Inequities.

Findings and Discussion

This study conducted a qualitative secondary analysis of national datasets and previous government policy documents was conducted on the basis of the All India Survey of Higher Education (AISHE - 2023), the Periodic Labour Force Survey (PLFS - 2022-23), and the Department of Science and Technology’s (DST) Women in Science Report (2020), among others. Contextual information was also collected from the United Nations Educational, Scientific and Cultural Organisation (2021). The focus of the analysis was to discover the intersectionality between women’s participation in STEM fields in India.

Gender Representation in STEM Education

According to the All-India Survey on Higher Education 2023 (AISHE, 2023), India has one of the highest percentages of women STEM graduates 43.2%, in the world. In biological sciences and chemistry, there are close to equal amounts of men and women; however, this is not true for computer science, engineering, and technology, where women only make up about 29% of the total number of students enrolled. In comparison, nearly 60% of students in science are women (Ministry of Education, 2023). These statistics indicate that we are making steady gains toward achieving gender parity in education; but this progress is occurring unevenly among various disciplines and across geographic areas. The states of Kerala, Tamil Nadu, and Karnataka have the highest degrees of participation by women, which is primarily due to the presence of a greater degree of educational infrastructure and social reform movements related to women’s education in these areas. Conversely, the northern and central states of Bihar, Uttar Pradesh, and Madhya Pradesh have a lower percentage of women enrolled in STEM fields and continue to have a lower number of women enrolled in STEM fields at the postgraduate level (UNESCO, 2021). Additionally, it is important to note that there is a significant number of private institutions providing a large portion of the enrolment of women, thus creating a situation of a paradox: while the overall number of women participating in technical education is high, the presence of significant structural inequities continues to dictate who has access to education and how.

Employment and Leadership Disparities

Women continue to face challenges transitioning from STEM fields to the workforce despite achieving high rates of graduation. This phenomenon is known as the “leaky pipeline” (Dasgupta & Sharma, 2021). According to PLFS data from 2022-2023, the percentage of women in the Labor Force Participation (LFP) Rate has not yet reached 25% for professional, technical, and scientific occupations. The proportion of women working as researchers and developers (R&D) is even less than this.

According to the Women in Science (WIS) Report published in 2020, women make up a small portion approximately 14% to 16% of faculty members at institutions focusing on science and engineering and that women are underrepresented in researcher positions at government-sponsored organisations, making up less than 18% of total research staff. The lack of representation of women continues to decrease in terms of leadership roles; only 7 to 9%, respectively, of department heads/principal investigators from large research are women (DST 2020). The qualitative findings suggest that the underrepresentation of women in these areas could be attributed to certain social and institutional factors, including gender biases in hiring processes, a lack of maternity and childcare support, and insufficient access to organised mentoring programmes designed specifically for the benefit of female scientists. Many women face “career discontinuity” during their late 20s and early 30s due to caregiving responsibilities, leading to a lower representation in higher academic and managerial ranks (Um, 2019). It demonstrates that while gender parity in education is measurable, gender equity in employment remains elusive. The workforce gap reflects not merely personal choices but systemic barriers embedded within academic and scientific institutions.

Caste, Class, and Regional Inequalities

The impact of caste and class on women’s access to and retention of STEM opportunities is substantial according to intersectional analysis. However, this has been overlooked in the national data systems. Neither AISHE nor PLFS has provided any intersectional data that connects women’s gender identity to their caste or socio-economic status, leaving Dalit, Bahujan and Adivasi women’s access to STEM programs entirely obscured (Gupta & Banerjee, 2020). In addition, the majority of women who have accessed government STEM programs have come from urban, upper-caste, English-speaking families (Research Matters, 2023). In contrast, women from under-represented castes are particularly disadvantaged in terms of being able to pursue higher education or science and technology careers because of limited access to quality schooling, cultural prohibitions against pursuing more technical-based careers, and socio-economic barriers to accessing private-sector higher education.

Regional inequality increases the difficulty of making these connections between caste and class. States in the southern part of India offer both more opportunities for women in STEM fields and a higher level of female literacy and workforce participation. Additionally, the women from under-represented castes are extremely under-represented in the highest-rated academic institutions, such as IITs and NITs. UNESCO’s Science Report (2021) describes that without data that breaks down region by region, disparities among women based on caste within an entire region are obscured.

Thus, intersectional inequities caste, class, region, and language form an invisible architecture of exclusion within India’s STEM ecosystem. The lack of intersectional data prevents policymakers from identifying which groups of women remain left behind.

Data and Policy Limitations

The qualitative analysis’s key finding is that the current data collection frameworks have limitations. For instance, while both AISHE (2023) and PLFS datasets categorize institutional, gender, and caste type, they fail to combine these into one dataset. Thus, it cannot be established how many Dalit or Adivasi women study or work in any area of STEM, for example, because this level of intersectionality is not captured in either dataset. This lack of intersectionality in data collection is not an isolated technical flaw; it is also indicative of structural flaws. Scholars of Feminism, such as Harding (1991) and Haraway (1988), have similarly argued that the data systems produce a reflection of social hierarchies; therefore, when gender is measured independently, it assumes all women will experience the same types of inequalities as women, through the type of single axis thinking discussed by Crenshaw (1989), which negates the differences between women. Progressive policies that have been implemented to increase women’s participation, such as Vigyan Jyoti and Women Scientists Scheme (WOS), have been evaluated by researchers and found to have the same shortcomings.

The results indicate that the data used to determine the Needs of Women from marginalized groups is not included in the analysis and, as a result, this lack of evidence will perpetuate the existing inequity between the sexes. Policymakers will likely accept that gender equity has been achieved due to the absence of intersectional evidence showing that systemic barriers continue to exist for large portions of society. Also, as a result of the findings, there are encouraging opportunities for Reform in Intersectionality.

Emerging Directions for Intersectional Reform

Although the analysis supports the existence of these gaps; the DST Women in Science Report (2020) indicates that more granular data must be collected related to Women in Science within STEM areas across Social and Regional Categories. Similar recommendations were made in the UNESCO Science Report (2021), which calls for the establishment of a National Data Observatory to combine Gender Indicators with Caste and Socio-Economic Indicators. The STEM Inclusion Agenda must include Structural as well as Numerical Representation of the Female Gender in India. Structural Inclusion must go beyond simply counting how many Women are counted as Participants and including how Many Women are excluded from participation. Additionally, programs and agencies must address the barriers to Women Retaining their positions within Institutions related to

rigid Hierarchical Structure, Gender Bias when Hiring Women, and the continual Devaluation of Women's Contributions to Research.

The increasing inequality within society is caused by not collecting and providing information on the needs of women from the marginalised communities. It is possible for policymakers to think that gender equity has been established, when in fact many women are still facing barriers to access and opportunity. Gender equity policies must work in conjunction with education, labour, and social justice departments to ensure that gender equity strategies account for differences in caste and region.

The qualitative analysis of secondary sources in the study indicates that gender-focused policies will not achieve intersectional equity; it requires a holistic approach, including qualitative monitoring and representation of women's voices during policy development. The "paradox" of India's gender equality framework can be attributed to the fact that it is primarily based on collecting numbers. Therefore, by counting the number of individuals who are participating, it fails to identify the qualitative factors contributing to the inequality that many individuals still face today, such as who has access, who has been excluded, and why.

Without data collection that considers intersections, it is impossible to create tailored interventions that target structural barriers, therefore keeping the voices of the most marginalised from being heard. The results of this research support the need for an overhaul of how national data systems have been developed to consider participation. Currently, national systems of collecting data on participation only consider the count of individuals who participated, whereas they should also consider the actual manners in which individuals participated. As such, to assess gender equity fully, indicators of caste, class, and regions of residence must be incorporated into the STEM monitoring framework.

This study supports the argument made by intersectional feminist theory that social inequities will exist as interconnected systems, not as separate variables (Crenshaw, 1989). By applying the lens of intersectionality to Indian STEM sectors, the importance of evaluating progress in gender inclusion alongside social justice measures can be established. Intersectional reform is, therefore, both a moral argument and a methodological requirement for accurately and inclusively representing data on all populations. As a result, the future of gender policy within Indian STEM sectors must be centrally focused on collecting intersectional data, directly representing inclusive policy positions, and utilising continuous qualitative monitoring; only through this approach can the nation evolve from merely achieving numerical parity in gender representation to establishing genuine social inclusion in the fields of science and technology.

Discussion and Suggestions

The analysis of existing sources of information, as well as Government and academic documents, including the All India Survey on Higher Education (2023), the Periodic Labour Force Survey (2023) and the Department of Science and Technology (2020) Women in Science Report show that the gender gap still exists in India's STEM ecosystem even though there are clear indications of growth in education. The results are ambiguous due to the fact that while many women are entering careers within STEM Education, they remain highly underrepresented in scientific employment, research, leadership positions etc. The analysis also utilises an Intersectional Feminist Framework to discuss the results and outlines Institutional & Policy Recommendations to improve the inclusivity of STEM in India.

There are many factors that prevent women from engaging fully with careers in Science, Technology, Engineering, and Mathematics (STEM) fields, including the structural and cultural conditions that inhibit women's full participation in STEM. While the number of women who graduate from institutions of higher learning has increased, particularly in southern India, such increases in access to education do not guarantee women equal outcomes in their careers. Many women graduate with degrees in science or engineering, yet may not pursue careers as researchers or engage in technical occupations, and this can be due to societal norms, lack of institutional support, or limited mobility (UNESCO, 2021). The gap between education and career is referred to as the "missing middle", and while the number of women entering STEM has increased, the number of women progressing professionally in STEM has not increased at the same rate (DST, 2020).

Data and policy frameworks in India reflect an outdated and unidimensional view of gender within a binary system. Data and government programs represent women in terms of gender representation using multiple variables, however, they do not take into account the intersectional nature of gender and caste, class, and geographic location (Gupta and Banerjee 2020). Missing this intersectional analysis causes us to inaccurately evaluate the experiences of women in STEM. By presenting an overarching definition of "women" as a monolithic group without differentiation for intra-gender differences women, institutions inadvertently favour the experiences of affluent, English-speaking urban upper-caste women while the experiences of Dalit Bahujan Adivasi and rural women are excluded as they are not represented statistically. The invisibility from a feminist perspective of these groups is indicative of the value placed on what is heard and/or omitted by government institutions regarding those individuals (Crenshaw 1989). Data do not exist in a vacuum; rather, they represent the values and priorities of the society that generated them and the entities that collected them.

Disparities in regions serve as catalysts for increasing inequalities. Even though southern states, such as Tamil Nadu, Kerala, and Karnataka have experienced a tremendous increase in female involvement in STEM due to an expansive network of educational institutions and more progressive views towards gender-norms, the bulk of their success stems from their heavy reliance on private institutions for higher education. While private institutions have allowed many women accesses to higher education, they have also replicated many economic barriers to education faced by women from lower economic backgrounds. The northern and eastern states continue to have low levels of female participation because of limited access to quality technical

education, cultural and social barriers affecting women's mobility, and the overarching socio-cultural context of STEM-related organizations. In addition, women in research positions within academia are frequently subjected to unconscious bias with respect to hiring and promotion, are frequently lacking appropriate mentorship, and are often expected to perform at a high level in their profession while caring for their families (UNESCO, 2021; DST, 2020).

For many individuals from marginalized groups, some of their barriers are caste discrimination and linguistic exclusion. Most universities have gender equity committees. However, these committees often do not possess the power or an intersectional awareness of discrimination (Gupta & Banerjee, 2020).

Intersectionality is a lens that offers a fuller explanation of such trends. Kimberl Crenshaw's (1989) breakthrough work highlighted how race, gender, class, etc. combined to determine people's differential experiences of discrimination. In India, women's entry into STEM fields is hugely influenced by their caste, class, and language. When public policies are based on non-intersectional data, it is as if all women experience science the same way, thus, hiding the multiple layers of exclusion. Hence, the study advocates for a change in focus from 'gender mainstreaming' to 'intersectional mainstreaming' (UNESCO, 2021).

Bright progress requires both policy making and institutional operations being changed. India programs and the Women Scientists Scheme have given the face of women scientists more exposure but still are elitist in terms of the society they serve (DST, 2020). Making the application process easier, giving information and instruction through regional languages, and granting special fellowships to first, generation and rural women scientists will definitely bring more equality into these schemes. Besides that, scientific institutions also need to change their ways of hiring and promotion by counting the time when women care for their children and thus lose out in their careers, creating mentoring circles and providing staff with anti, bias training.

On the systemic side, India needs a clear and intersectional data infrastructure. Surveys like AISHE and PLFS should associate gender with caste, rural, urban background, and type of the institution. A partnership between the Ministry of Education and DST can create a national STEM diversity index publicly available database that tracks participation of social groups. Performing regular gender and diversity audits in higher education will enhance accountability and targeting of policy intervention (Emma, 2025). Also, encouraging participatory research on experiences of Dalit, Adivasi, and rural women in STEM will help to produce the short, term field evidence for better policy.

Inclusion should not be solely considered as a numeric goal but as a revolutionary process. Achieving gender equality in STEM means tearing down traditional boundaries that defined that could be considered a producer of knowledge and it also means making diversity a value of an institution. Hence, intersectional inclusion is not only a matter of justice but also the innovation engine. The scientific progress of India will be largely influenced by its capability to desegregate its knowledge systems and thus mirror the diversity of the society it is intended for.

Conclusion

This research examined the paradox of women's involvement in India's science, technology, engineering, and math (STEM) fields by conducting a qualitative secondary analysis of national reports and policy data. The study results demonstrate that women, while making up a significant portion of STEM graduates, are still rare in research positions, campus faculty, and scientific leadership roles. The difference between education and career results in access not being the only factor ensuring equality. Women's advancement in science careers is still being hindered by structural, institutional, and cultural barriers, the article discusses that gender is treated as a single category in India's policy and data systems, which do not consider the intersections of caste, class, region, and institutional type. This limited viewpoint hides the realities of marginalized women, especially Dalit, Bahujan, Adivasi, and rural women whose experiences are missing from official statistics. Consequently, progress frequently looks wider than it really is. Closing this divide necessitates the collection of intersectional data, the implementation of targeted inclusion policies, and institutional changes that acknowledge diversity in women. Changing the hiring systems, providing career, entry opportunities, and mentoring underrepresented female workers are steps that have to be combined with a broader cultural change in the environments of academics and research.

Gender equality in STEM needs to be more than just getting the numbers right, it should lead to real structural changes. India will only be able to break away from its gender paradox and build a STEM environment that is fair and innovative if intersectionality is at the core of policies and institutional practices.

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