

Original Research Article

Tracing the Current Status of Gender In(Equality) in Indian Primary, Upper Primary, Secondary and Higher Secondary Education: A State-Specific Analysis

Abstract

Gender equality in education is essential for human capital formation, social justice, and inclusive economic growth. Despite sustained policy efforts, gender disparities persist across Indian states, particularly at higher levels of education. This study examines the extent and determinants of gender inequality in education across Indian states from 2011–12 to 2024–25, focusing on primary to higher secondary levels. Using state-level panel data from UDISE+, the Census, National Sample Survey, and other government sources, gender inequality is measured through Gross Enrollment Ratios (GER). Descriptive statistics and panel regression analysis reveal that gender parity has largely been achieved at the primary level due to improved access and targeted interventions, but disparities re-emerge at secondary and higher secondary levels because of retention and dropout challenges. Female literacy emerges as the most significant factor in reducing gender gaps, supported by the availability of female teachers, school access, and women's workforce participation, while infrastructure alone proves insufficient. The study highlights substantial interstate variation and emphasizes the need for state-specific, evidence-based policies to achieve sustainable gender equality in education.

Keywords: Gender inequality, Education in India, Gross Enrolment Ratio, Female literacy, female work participation.

1. Introduction

Gender equality in education plays an essential role in inclusive development and growth. In India, despite an improved enrolment of girls in primary as well as upper primary classes, large gender inequalities exist in the secondary and higher secondary stages. This restricts progress in Sustainable Development Goals 4&5.

There also prevails some gaps regarding the genders in India. Although there are some states like Kerala, Tamil Nadu, Himachal Pradesh, and Goa, which are successfully able to accomplish equality between the genders, Rajasthan, Bihar, Uttar Pradesh, and Madhya Pradesh are also witnessing some gaps between the genders. This also helps one to ascertain the importance of knowing about each state uniquely regarding their socio-economics and education facilities.

Although various factors such as female literacy rates, participation of females in the workforce, various aspects of the household structure, income, inflation rates, and educational infrastructure have been identified as important determinants of differences in educational outcomes between genders in existing literature, most studies have incorporated only one level of education or have analyzed independent variables singularly.

The present research fills the above gap by making use of the state-level panel data ranging from 2011 to 2024 to analyze the gender gap in the Gross Enrolment Ratios at the primary, upper primary, secondary, and higher secondary levels of education. The research utilizes panel regression methods to analyze the impact of female literacy rates, female employment rates, household size, income, inflation, number of schools, female teachers, and school infrastructure. The research analyzes the education lifecycle and points out the points at which the gender gap widens.

Objectives of the Study

Firstly, to examine the extent and trends of gender inequality in education across Indian states at the primary, upper primary, secondary, and higher secondary levels from 2012 to 2024.

Secondly, to analyse the socio-economic and institutional factors influencing gender gaps in educational participation across different schooling levels in India.

2. Review of Literature

It is commonly acknowledged that gender equality in education is a key factor in social justice, inclusive economic growth, and the development of human capital. According to traditional human capital theory, education increases lifetime incomes and individual productivity, which promotes economic growth (Becker, 1964; Schultz, 1988). Gender-focused development theories, which support this viewpoint, say that investing in girls' education produces greater social returns because of significant intergenerational

consequences, such as better child health, lower reproduction, and better educational outcomes for future generations. As a result, national development plans and global policy frameworks like the Sustainable Development Goals (SDGs), which were established in 2015, now prioritize addressing gender gaps in education.

Despite substantial progress in expanding educational access, gender inequality in education remains a persistent challenge in many developing countries, including India. While enrolment gaps between boys and girls have narrowed significantly at the elementary level, empirical studies consistently show that these gaps widen at secondary and higher levels of education (Psacharopoulos & Patrinos, 2018). This pattern reflects increasing opportunity costs of schooling for girls as they grow older, along with socio cultural constraints such as early marriage, household responsibilities, safety concerns, and limited access to post-primary educational institutions. These constraints disproportionately affect girls during adolescence, leading to higher dropout rates.

India has implemented several large-scale policy initiatives to promote universal access to education.

Programmes such as the Sarva Shiksha Abhiyan (SSA), the Right to Education (RTE) Act of 2009, and the nationwide expansion of the Mid-Day Meal Scheme have played a crucial role in improving enrolment and reducing gender gaps at the primary level. Empirical evidence suggests that primary school enrolment in India is now near universal, with girls' participation matching or exceeding that of boys in many states (Kingdon, 2007; Dreze & Sen, 2013; Tilak, 2015). These achievements demonstrate the effectiveness of demand-side incentives and improved school accessibility in overcoming early barriers to girls education.

However, the literature highlights that gender parity at the elementary level does not automatically translate into equality at higher stages of education. Studies based on data from the National Sample Survey (NSS) and the Census of India reveal a sharp increase in dropout rates among girls as they transition from upper primary to secondary and higher secondary education (Desai & Kulkarni, 2008). Factors such as early marriage, care giving responsibilities, menstruation-related challenges, safety concerns, and the lack of nearby secondary schools significantly limit girls' ability to continue their education. The PROBE Report (2019) further emphasises that social norms and infrastructural gaps jointly contribute to widening gender disparities at post-primary levels.

Interstate disparities form a central theme in the literature on gender inequality in Indian education. Southern and western states such as Kerala, Tamil Nadu, Maharashtra, and Himachal Pradesh consistently perform better in achieving gender parity across all educational levels. These states benefit from higher female literacy rates, relatively progressive social norms, better governance, and sustained public investment in education (Chakrabarti, 2016). In contrast, states such as Bihar, Rajasthan, Uttar Pradesh, Madhya Pradesh, and Jharkhand continue to experience significant gender gaps, particularly at secondary and higher secondary levels. These differences are attributed to variations in economic development, cultural attitudes, and the availability of educational infrastructure.

Recent empirical studies focusing on specific states and regions reinforce these findings. Gupta and Prakash (2024), in their analysis of Jharkhand, document persistent gender disparities in literacy and enrolment despite the presence of government initiatives. Their study shows that although female gross enrolment ratios have improved in recent years, female participation remains low at higher levels of education. Similarly, Gogoi, Hazarika, and Gogoi (2025), using data from the NSS and the Periodic Labour Force Survey (PLFS), find that female enrolment remains relatively high at elementary levels but declines sharply at secondary and higher secondary stages. While acknowledging modest improvements following integrated education programmes introduced after 2018–19, their study highlights continued regional and stage-wise disparities.

A substantial body of literature identifies female literacy as one of the most important determinants of gender equality in education. Basu (2002) argues that educated women are more likely to support their daughters' education, delay early marriage, and challenge discriminatory household practices. Jensen (2012) provides empirical evidence that maternal education significantly reduces the probability of girls dropping out of school, particularly during adolescence. These findings underscore the intergenerational transmission of educational advantages and the critical role of female literacy in sustaining girls' educational participation.

Women's economic participation also plays a significant role in shaping educational outcomes. Klasen and Pieters (2015) find that women's employment increases their bargaining power within households, leading to greater investment in girls' education. However, the nature of employment matters, as low-paid or informal work may increase

girls' domestic responsibilities and negatively affect school attendance. Household characteristics such as family size and dependency ratios further influence educational decisions. While extended family structures may provide support for girls' schooling in some contexts, resource constraints in larger households can limit educational investment (Jensen, 2012).

Educational infrastructure is another critical determinant of gender outcomes, particularly at higher levels of schooling. The availability of secondary schools, female teachers, and basic facilities such as separate toilets significantly reduces dropout rates among adolescent girls (Muralidharan and Prakash 2017). However, Asadullah and Chaudhury (2013) caution that infrastructure expansion alone may be insufficient without parallel efforts to address safety concerns, mobility restrictions, and social norms.

Despite extensive research, important gaps remain in the literature. Many studies focus on a single educational stage or specific regions and rely heavily on cross-sectional or descriptive analyses. Relatively few studies adopt a comprehensive, state-level panel data approach that captures both spatial and temporal variations across multiple stages of education. By examining gender inequality in education across primary, upper primary, secondary, and higher secondary levels in India from 2011–12 to 2024–25, the present study addresses these gaps and contributes to a more integrated understanding of the regional and structural determinants of gender equality in education.

3. Methodology and Data Source

3.1. Methodology

The present study adopts an empirical research methodology to examine the extent of gender inequality in education in India and to analyze the factors influencing female educational outcomes over time and across states. The study uses quantitative techniques to identify relationships, and trends in gender-based educational indicators.

To achieve the objectives of the study, regression analysis, and trend analysis are employed. These methods help in understanding disparities between male and female educational participation and in evaluating the role of socio-economic factors in reducing gender gaps in education.

The following techniques are used in the study:

Panel Regression Analysis

Data Description

The study is based on secondary panel data covering the period 2011 to 2024, which provides a comprehensive view of gender equality trends in education across Indian states.

The dependent variables used in the analysis are:

- Primary gender gap
- Upper primary gender gap
- Secondary gender gap
- Higher secondary gap

These indicators are widely used to measure gender equality in education in different domain.

Independent Variables

The independent variables included in the study are:

- Female literacy rate
- Inflation
- Per capita income
- Female teacher percentage
- Average Household size
- Number of schools
- School infrastructure index
- female work participation

The selection of variables is based on existing literature and their relevance in explaining gender disparities in education.

Panel Regression Analysis

Panel regression analysis is employed to examine the impact of selected socio-economic variables on gender equality in education across Indian states.

The analysis focuses on:

- The effect of income levels on female educational participation

- The role of female work ,female teacher ,female literacy in improving gender parity
- The influence of number of school and infrastructure on girls' education
- The impact of average household size on gender equality outcomes

3.2. Data Sources and Variables:

In the present paper, twelve variables are used, primary gender gap , upper primary gender gap , secondary gender gap, higher secondary gender gap, per capita income, female workforce participation , female literacy ,female teacher ,inflation rate ,number of school , household size and school infrastructure have been used. The study is based on panel data from the year 2011 to 2024 of India. These secondary data are collected from Unified District information system of Education Plus(UDISE+), Reserve Bank Of India(RBI) ,Consumer Price Index(CPI),Census, National sample Survey(NSS), Ministry of statistics and program implementation(MSOPI),Ministry of finance, State Economic Surveys, consumer price index reports, Household size data, state level education surveys, Ministry of education.

3. Result & Discussion

Table 1. Primary Gender Gap(I-V)

State	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Andhra Pradesh	0.15	1.36	1.54	2.39	6.25	7.27	5.21	4.02	2.36	0.12	0.45	0.4	-1.6

Arunachal Pradesh	3.25	1.96	2.05	2.54	3.54	0.17	-0.03	-2.16	-3.98	-1.69	-2.05	-1.4	-4.5
Assam	-7	-2.8	-2.19	-1.55	-0.94	-2.96	-3.22	-4.21	-5.76	-7	-3.85	-3.9	-9.55
Bihar	-7.13	-5.19	-4.17	-3.58	-3.22	-2.46	-3.12	-3.3	-2.09	-2.69	-4.95	-1.05	-4.75
Chhattisgarh	1.36	1.2	1.66	1.64	1.7	0.76	0.94	0.2	0.01	-0.25	-0.25	-0.3	-2.4
Goa	2.81	1.15	-0.42	-1.43	-1.7	-3.51	-3.99	-4.09	-4.2	-4.15	1.65	1.95	-2.65
Gujrat	0.45	0.5	0.24	-0.22	-0.51	-0.62	-2.24	-3.55	-4.36	-5.44	-2.75	-2.75	-4.25
Haryana	-1.73	-2.02	-1.17	-0.31	1.53	1.26	0.92	0.51	-0.38	-1.48	0.6	-0.35	-3.65
Himachal Pradesh	-1.01	-1.24	-1.67	-1.51	-1.3	-2.01	-1.64	-1.49	-1.42	-1.21	-0.45	-0.45	-2.75
Jharkhand	-1.73	-0.74	-0.08	0.48	3.03	2.2	1.38	-0.07	-0.47	-1.44	0.1	0.3	-2.65
Karnataka	1.9	1.1	1.14	1.42	2.83	2.47	2.17	1.09	-0.08	-0.42	-0.45	-0.75	-2.2
Kerala	0.84	0.96	0.72	0.57	0.57	0.61	0.22	0.38	0.1	0.69	0.3	0.1	-1.3
Madhya Pradesh	-1.31	1.94	3.63	4.34	3.98	2.15	1.19	0.48	0.06	-0.24	-3.25	0.95	-0.9
Maharashtra	0.73	0.83	1.03	1.49	1.96	1.52	0.38	-0.89	-2.9	-4.96	-3.5	-4.4	-5.7
Manipur	-6.89	-7.33	-4.22	-4.2	-0.38	0.51	-2.66	-3.46	-5.1	-5.57	-2.9	-2.55	-4.4
Meghalaya	-4.41	-4.52	-3.89	-3.63	-0.9	-1.44	-3.95	-4.26	-5.71	-7.38	-3.7	-2.85	-12.4
Mizoram	6.97	4.45	4.98	4.63	4.86	3.37	3.37	1.48	1.27	-0.64	-1.15	-1.15	-3.4
Nagaland	-4.1	-3.97	-2.14	-2.31	-1.36	-2.44	-2.2	-3.51	-4.8	-5.57	-2.95	-2.6	-5.65
Odisha	2.72	2.4	2.26	1.68	1.4	0.46	1.17	0.89	0.89	0.36	0.75	0.5	-0.9
Punjab	0.06	-0.41	-0.73	-0.37	-0.89	-0.65	-0.05	0.22	1.07	1	0.6	0.25	-2.15
Rajasthan	0.98	2.74	4.06	3.88	3.69	2.47	-0.04	-1.52	-1.69	-2.88	-1.1	-1.25	-2.55
Sikkim	8.61	8.36	9.76	9.85	9.37	8.3	8.18	7.79	7.16	6.66	3.7	3.45	0.2

Tamilnadu	-0.73	-0.37	-0.48	-0.66	0.5	0.16	0.37	-0.71	-1.35	-1.89	-0.95	-1.05	-2.65
Telangana	0.56	0.56	0.56	1.2	2.15	0.88	0.61	-0.33	-0.88	-0.99	-0.6	-0.65	-3.35
Tripura	-0.4	-0.75	-0.42	-0.12	-0.3	-0.98	-2.22	-3.38	-4.63	-4.44	-2.35	-2.45	-5.5
Uttarakhand	-1.32	-0.8	-0.49	-0.62	-0.12	-0.63	-1.45	-2.97	-3.99	-5.92	-2.8	-3.3	-6.2
Uttar Pradesh	-6.82	-5.52	-6.07	-5.83	-5	-5.02	-4.29	-5.08	-5.21	-4.4	-3.35	-1	-3.05
West Bengal	-2.38	-0.78	0.19	0.63	2.38	0.96	-0.64	-1.11	-0.55	-1.17	-1.3	-1.35	-3.4

Figure 1: Primary Gender Gap

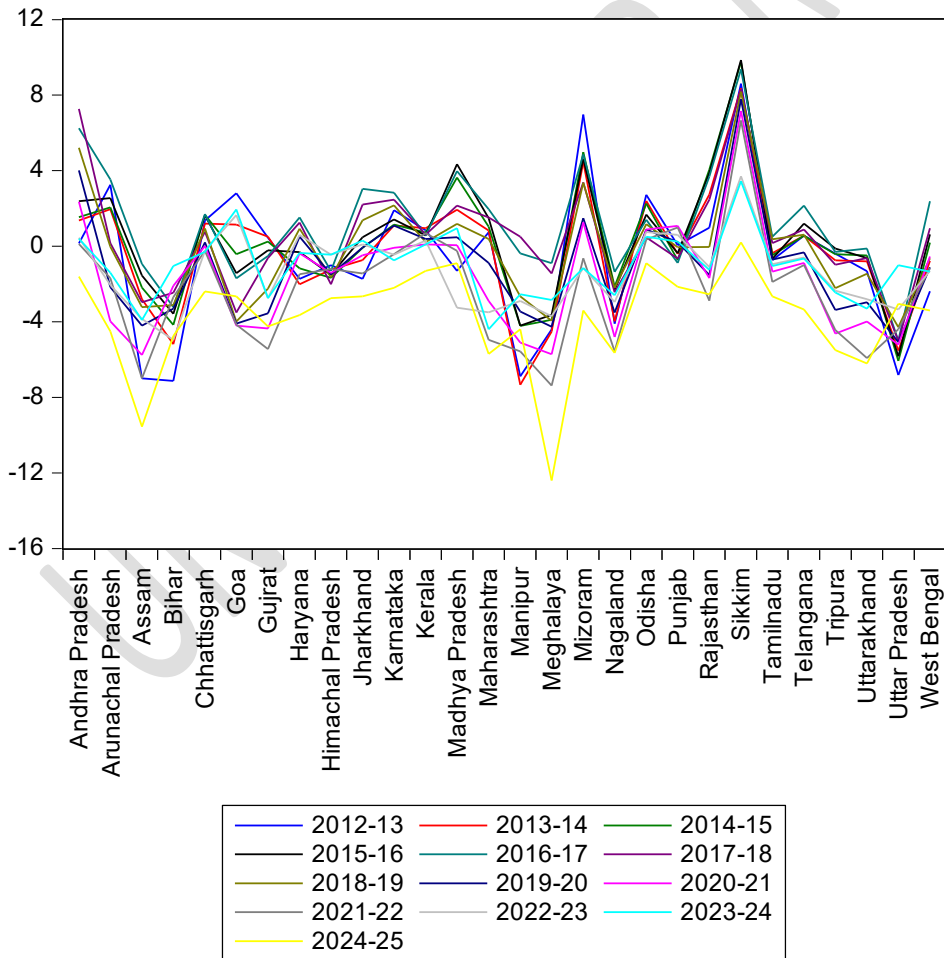


Table 1 shows wide variation in gender gaps at the primary level across Indian states. States like Assam, Bihar, Manipur, Meghalaya, Nagaland, Tripura, and Uttar Pradesh show negative gaps, indicating higher enrolment of girls due to schemes such as mid-day meals and free uniforms. States such as Mizoram, Sikkim, Karnataka, Chhattisgarh, Odisha, and Andhra Pradesh show fluctuating gaps because of policy changes and demographic factors. Haryana, Gujarat, Rajasthan, and Madhya Pradesh mostly show gaps favoring boys due to cultural factors, though these gaps have reduced over time, showing progress toward gender parity.

Table 2: Upper Primary Gender gap (VI-VIII)

State	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Andhra Pradesh	-4.98	-3.37	-0.22	0.04	0.79	1.71	1.81	2.44	3.43	4.76	4.3	2.1	-0.5
Arunachal Pradesh	-1.86	-1.07	-2.52	-2.96	-4.07	-5.68	-6.17	-5.73	-7.46	-6.06	-6.6	-7.2	-6.6
Assam	-9.36	-9.93	-10.17	-8.88	-8.75	-8.74	-8.9	-9.05	-9.57	-9.36	-9.7	-11.9	-19.6
Bihar	-8.43	-9.16	-9.36	-9.04	-8.31	-7.46	-7.18	-6.85	-5.13	-2.3	-7.6	-2.2	-7.1
Chhattisgarh	-0.5	-0.39	-0.01	-0.37	-1.51	-0.72	-0.65	-0.74	-0.59	-0.42	-1.1	-1.6	-7.8
Goa	2.17	1.81	0.38	0.44	1.16	0.49	-1.12	-1.97	-3.08	-2.62	-4.7	-5.2	-4.9
Gujrat	4.73	5.52	5.02	4.03	2.95	2.25	0.77	-0.26	-0.4	-0.41	-0.3	-1.6	2.7
Haryana	-0.04	-0.59	-0.98	-1.43	-0.35	0.39	0.43	0.95	1.38	1.3	2.4	0.1	0.1
Himachal Pradesh	0.96	-0.2	-1.5	-1.8	-1.49	-1.02	-1.12	-1.52	-2.35	-2.77	-2	-2.1	-3.6
Jharkhand	-5.64	-5.4	-5.1	-5.18	-3.38	-3.62	-3.91	-4.43	-3.29	-1.73	-0.9	-1.2	-6.2
Karnataka	1.03	0.85	0.53	0.76	2.69	1.65	1.58	0.31	0.66	1.39	1.8	0.7	-1.4
Kerala	1.69	1.55	1.19	0.84	0.56	0.95	0.25	0.39	0.24	0.53	0	-0.3	-1.3
Madhya Pradesh	-8.48	-6.56	-3.49	-1.02	1.87	2.81	2.88	2.32	2.21	2.13	-4.2	0.7	0

Maharashtra	2.13	2.42	1.98	1.24	0.91	0.87	0.96	0.98	1.31	1.7	1	-1.2	0.4
Manipur	-3.03	-2.69	-4.83	-3.67	-3.74	-1.92	-2.65	-3.18	-3.56	-3.93	-3.6	-4.2	-4.7
Meghalaya	-	-	-	-	-	-	-	-	-	-	-19	-19.4	-27.2
	12.48	13.99	12.94	13.66	12.37	12.48	14.44	15.38	15.89	16.36			
Mizoram	2.31	2.36	2.8	3.47	2.48	1.3	1.3	-0.33	-1.5	-2.48	-3.7	-4.6	-13.1
Nagaland	-5.6	-5.4	-4.57	-4.68	-3.58	-3.27	-5.21	-6.53	-6.58	-6.84	-7	-7.2	-10.3
Odisha	1.11	1.31	1.76	2.5	3.12	2.71	2.99	2.2	1.49	-0.02	0.5	0.9	-1.9
Punjab	1.84	1.88	1.5	0.53	-0.49	-0.89	-0.96	-2.16	-0.61	-2.51	-2.2	-1.1	-5
Rajasthan	7.47	8.21	8.32	6.9	6.48	6.34	6.26	5.73	4.76	3.97	2.5	0.1	1.9
Sikkim	-	-8.94	-9.54	-8.98	-6.14	-6.08	-3.19	-1.75	-1.62	-0.58	0	-1.1	-3.1
	14.85												
Tamilnadu	-1.95	-0.98	-0.71	-0.75	-0.86	-0.19	0.53	0.37	0.53	0.91	0.2	-0.2	-2.2
Telangana	-1.93	-1.93	-1.93	-1.54	-0.65	-0.71	-0.37	-0.13	1.28	2.04	0.2	-1.3	-3.1
Tripura	0.34	-0.26	-1.47	-1.85	-2.27	-2.29	-3.14	-3.32	-2.95	-3.78	-4.7	-5.3	-9.2
Uttarakhand	-4.72	-3.02	-3.26	-2.76	-2.56	-1.74	-2.09	-1.95	-1.8	-1.85	-2.6	-3.6	-4.8
Uttar Pradesh	-9.81	-8.62	-8.4	-7.95	-7.15	-5.6	-3.58	-3.03	-2.59	-1.93	-4.6	-2.6	0
West Bengal	-	-	-	-	-9.87	-8.79	-6.73	-5.45	-3.93	-1.91	-1.4	-2	-10.6
	11.87	11.93	11.34	10.53									

Figure 2:Upper Primary Gender Gap

Andhra Pradesh	-3.13	-3.99	-1.05	-0.07	0.57	0.33	0.67	0.4	1.44	1.79	-2.2	-1.3	-6.9
Arunachal Pradesh	5.93	4.86	3.38	2.98	1.35	-0.66	-2.29	-7.36	-6.19	-3.08	-4.6	-5.4	-4.2
Assam	-	-	-9.4	-8.5	-8.61	-8.57	-	-	-	-	-9.5	-10.4	-7.6
	13.47	10.03					11.68	13.01	13.07	13.47			
Bihar	-2.05	-2.44	-4.27	-6.29	-6.89	-5.78	-6.03	-4.87	-4.12	-3.71	-7.4	-3.9	-4.5
Chhattisgarh	-2.26	-3.1	-4.09	-5	-5.48	-5.97	-9.97	-6.66	-6.19	-6.18	-9.3	-9.9	-14.3
Goa	0.77	2.87	4.07	-0.74	0.27	0	-1.7	-1.94	0.58	-5.16	-7.7	-10	-16.6
Gujrat	13.87	15.83	15.64	15.42	13.94	13.71	12.3	11.24	8.35	4.35	1.8	-0.6	-4.5
Haryana	1.42	2.61	4.09	3.92	3.56	3.3	3.89	4.78	3.96	2.75	0.2	-1.3	-5.5
Himachal Pradesh	2.84	4.48	4.32	3.99	1.77	-0.05	-0.55	-0.06	1.32	-1.37	-3.3	-4.8	-7.6
Jharkhand	-0.31	-1.07	-2.53	-2.74	-2.84	-3.14	-3.77	-4.12	-4.24	-4.18	-3.4	-3.7	-4.5
Karnataka	0.28	0.58	1.26	1.37	2.41	1.64	1.79	2.11	1.68	-0.36	-4.8	-6.1	-14.5
Kerala	3.6	3.82	2.05	1.8	1.38	1.28	1.1	0.89	0.56	0.86	-2.4	-2.3	-4.4
Madhya Pradesh	0.71	2.4	3.68	5.34	4.96	5.35	5.35	5.78	4.3	2.93	-2.4	-0.3	-3.7
Maharashtra	3.63	4.62	4.82	6.04	6.24	4.36	2.84	2.78	2.58	2.18	0.7	-0.2	-2.6
Manipur	-1.45	-1.19	-0.63	-0.46	-1.41	-1.45	-2.5	-2.29	-2.57	-2.69	-0.8	-1.5	-1.5
Meghalaya	-9.71	-10.3	-	-	-	-	-	-	-	-	-19	-19.1	-13.5
			10.84	11.82	12.08	12.69	14.77	17.22	18.73	18.35			
Mizoram	-2.26	-1.39	-2.4	-3.68	-4.45	-5.88	-5.88	-7.33	-	-8.81	-10.2	-9.3	-9.6
									11.05				
Nagaland	-3.69	-4.78	-4.95	-5.24	-5.59	-4.68	-6.91	-7.21	-8.34	-9.34	-7.9	-8.4	-6.9
Odisha	-0.81	-0.89	-0.58	-1.36	-0.79	-0.52	0.61	-0.13	1.8	-0.46	-2.4	-2.5	-5.8
Punjab	0.89	2.97	3.51	4.85	4.43	2.1	-0.25	-3.88	2.58	-0.62	-2.5	-4.1	-6.2
Rajasthan	17.11	15.89	15.65	13.85	12	10.68	9.73	9.73	9.49	6.57	5.6	2.6	1.9
Sikkim	-	-	-12.5	-	-	-	-	-	-8.23	-5.71	-9.6	-7.6	-10.5
	12.37	13.66		11.58	10.39	12.51	12.78	11.72					
Tamilnadu	0.86	1.01	-0.97	-1.58	-2.93	-1.84	-1	-1.01	0.09	0.25	-5.9	-6	-11.1
Telangana	-3.65	-3.65	-3.65	-3.14	-2.4	-2.58	-2.21	-1.59	-0.67	-0.91	-1.8	-4.1	-9.4
Tripura	0.75	-0.52	-2.55	-4.75	-5.96	-7.22	-7.11	-6.16	-7.99	-5.9	-7.7	-7.3	-8.4

Uttarakhand	-2.05	-1.13	-2.25	-1.74	-3.2	-1.77	-1.77	-0.5	-0.27	-1.69	-3.4	-5.6	-7.5
Uttar Pradesh	1.5	-0.53	-0.41	0.91	3.41	4.68	4.1	4.82	6.61	5.84	2.6	2.6	0.4
West Bengal	-	-	-	-	-	-	-	-	-18.8	-9.72	-13.6	-12.2	-11.1

Figure 3: Secondary Gender gap

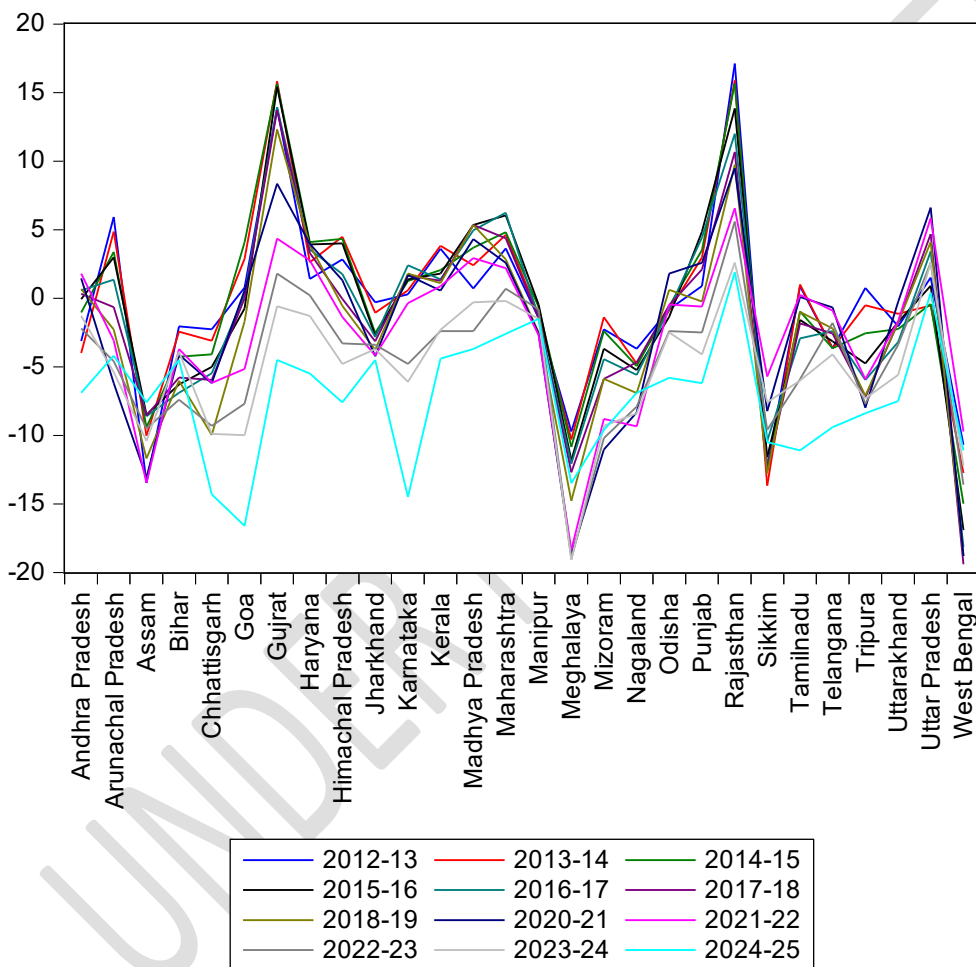


Table 3 shows that the largest gender gaps appear at the secondary level due to higher girl dropouts caused by early marriage, poverty, and safety concerns. States like Gujarat, Rajasthan, Haryana, Punjab, Karnataka, and Maharashtra show large positive gaps favouring boys; Gujarat records gaps above +15 during 2012–2015, indicating severe imbalance. In contrast, northeastern states such as Manipur, Meghalaya, Mizoram, Nagaland, and Sikkim

show negative gaps due to higher female literacy and matrilineal social structures. States like Bihar, Uttar Pradesh, Odisha, West Bengal, and Jharkhand perform better because of schemes such as Kanya Utthan Yojana, Ladli Lakshmi Yojana, bicycle schemes, and cash transfers. Kerala and Tamil Nadu show minimal gaps, indicating near gender equality.

Table 4: Higher Secondary Gender gap (XI-XII)

state	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Andhra Pradesh	2.83	-0.26	0.44	-0.85	0	-3.72	-3.16	-6.76	-3.16	-3.05	-2.2	-1.3	-6.9
Arunachal Pradesh	4.66	1.99	1.18	0.47	-1.09	-1.05	-1.63	-5.61	-4.73	-4.71	-4.6	-5.4	-4.2
Assam	-4.13	-0.01	-0.2	1.15	-0.04	-0.36	0.11	-1.05	-1.51	-4.13	-9.5	-10.4	-7.6
Bihar	0.48	0.37	1.51	0.44	1.02	1.71	0.1	-0.38	-0.93	-0.61	-7.4	-3.9	-4.5
Chhattisgarh	3.32	2.14	1.33	-0.59	-3.15	-3.18	-7.21	-9.39	-	-10.7	-9.3	-9.9	-14.3
Goa	-3.33	-6.17	-	-9.87	-	-	-	-	-8.45	-5.1	-7.7	-10	-16.6
Gujrat	5.23	5.7	4.88	3.41	2.73	3.55	1.71	0.7	-0.29	0.8	1.8	-0.6	-4.5
Haryana	0.93	2.2	3.24	1.68	2.1	2.25	0.1	-2.49	-2.77	-0.87	0.2	-1.3	-5.5
Himachal Pradesh	-0.72	-1.11	-0.25	-0.42	-0.46	-1.49	-4.7	-6.72	-5.47	-2.36	-3.3	-4.8	-7.6
Jharkhand	2.35	2	1.8	1.51	0.85	1.34	-0.88	-0.58	-1.51	-3.07	-3.4	-3.7	-4.5
Karnataka	-1.79	-2.56	-3.52	-4.51	0.02	-4.55	-8.42	-8.52	-6.92	-4.19	-4.8	-6.1	-14.5
Kerala	-6.82	-8.56	-8.42	-9.41	-	-	-8.94	-8	-7.54	-6.58	-2.4	-2.3	-4.4
Madhya Pradesh	4.66	5.31	4.89	4.16	3.14	2.54	2.02	0.46	-0.16	1.25	-2.4	-0.3	-3.7
Maharashtra	0.26	0.98	2.11	2.8	2.98	3.67	3.48	0.51	0.05	1.11	0.7	-0.2	-2.6
Manipur	4.24	4.51	3.63	4.28	2.58	4.39	2.99	1.11	1.02	0.3	-0.8	-1.5	-1.5

Meghalaya	-5.27	-6.03	-7.38	-6.3	-5.04	-5.86	-8.29	-9	-9.09	-13.3	-19	-19.1	-13.5
Mizoram	-0.12	-2.09	-0.68	-3.62	-4.19	-5.14	-5.14	-5.18	-5.56	-8.6	-10.2	-9.3	-9.6
Nagaland	2.36	1.11	0.79	0.07	-0.76	-1.91	-3.12	-2.97	-4.9	-5.78	-7.9	-8.4	-6.9
Odisha	0.22	0.25	0.2	0.2	0.2	-0.3	-7.34	-1.68	-3.18	-3.63	-2.4	-2.5	-5.8
Punjab	-1.85	-0.51	-0.21	-0.61	-0.79	-1.09	-1.3	-3.93	-3.4	-1.93	-2.5	-4.1	-6.2
Rajasthan	14.78	15.42	14.82	13.77	12.08	11.77	10.2	8.34	6.96	7.73	5.6	2.6	1.9
Sikkim	-7.45	-11.9	-	-	-	-	-	-	-	-	-9.6	-7.6	-10.5
			12.71	13.21	12.08	11.16	14.05	11.69	14.43	15.43			
Tamilnadu	-12.8	-	-	-	-	-	-	-	-11.8	-8.57	-5.9	-6	-11.1
		13.19	12.59	13.24	14.07	14.23	15.15	14.34					
Telangana	-2.69	-2.69	-2.69	-4.94	-5.73	-7.83	-8.04	-8.44	-4.74	-3.57	-1.8	-4.1	-9.4
Tripura	7.16	7.19	5.54	3.32	2.28	0.52	-1.08	-2.41	-5.24	-7.97	-7.7	-7.3	-8.4
Uttarakhand	-2.38	-2.22	-3.22	-5.13	-3.93	-4.55	-5.94	-6.84	-6.43	-3.45	-3.4	-5.6	-7.5
Uttar Pradesh	1.48	-1.36	-1.04	-0.5	-0.31	0.88	1.88	2.83	3.69	4.43	2.6	2.6	0.4
West Bengal	2.27	1.1	-1.04	-2.77	-4.82	-7.97	-9.4	-	-	-	-13.6	-12.2	-11.1
								10.54	10.73	16.88			

Figure 4 :Higher Secondary Gender Gap

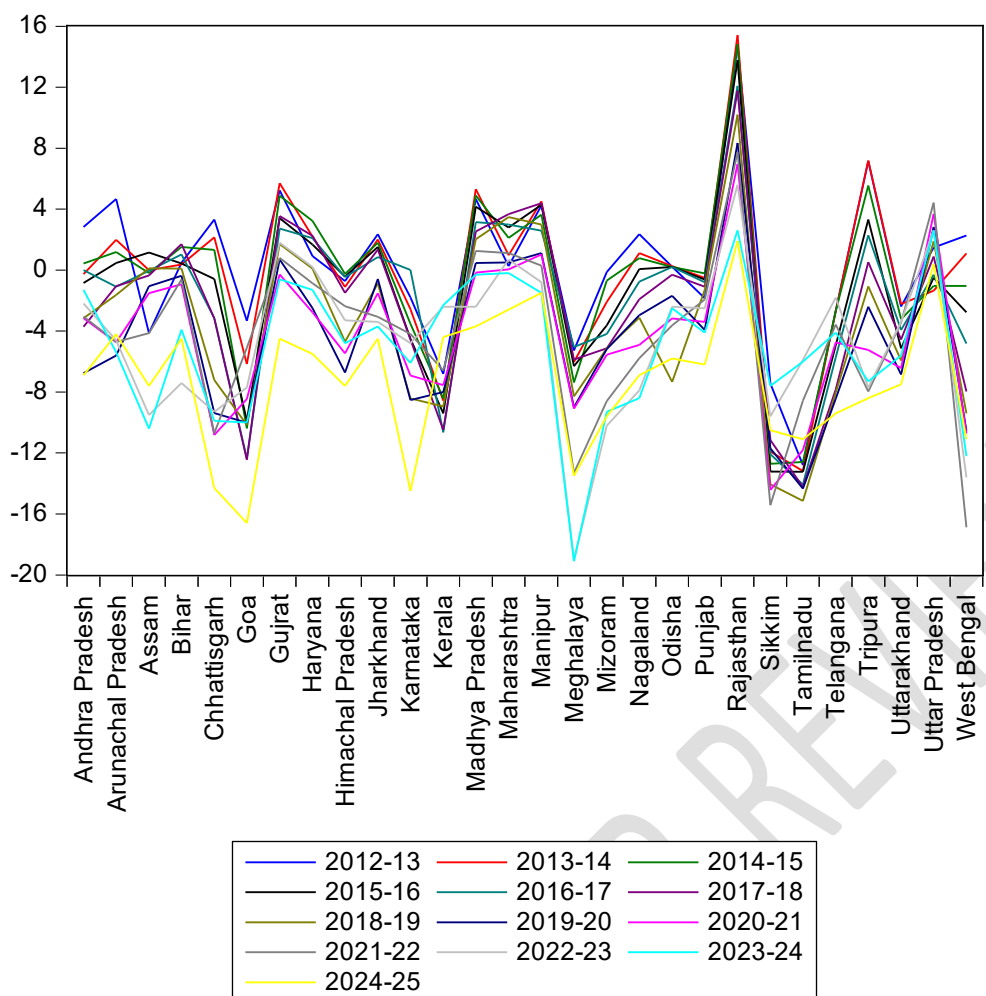


Table 4 shows that gender inequality rises sharply at the higher secondary level due to high girl dropouts caused by poverty, early marriage, social norms, and poor infrastructure. States such as Rajasthan, Gujarat, and West Bengal show wide positive gaps favouring boys, Rajasthan records gaps above +14. Central and western states like Madhya Pradesh and Maharashtra initially show male-favouring gaps, but these are declining due to gender-focused policies. Northeastern states such as Sikkim, Meghalaya, Manipur, and Mizoram show negative gaps, indicating an advantage for girls, especially in Meghalaya. Southern states like Tamil Nadu and Kerala show near-zero or negative gaps due to strong institutions and greater acceptance of girls' education. Determinants of gender gap in India of primary , upper primary ,secondary and higher secondary education.

Table 5 :Primary Gender Gap

Variable	Coefficient	t-Statistic	Prob.
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C	16.11571***	11.79552	0.0000
PERCAPITAINCOMEINR	-1.25E-05***	-2.90706	0.0039
FEMALELITERACY	-0.09236***	-6.61469	0.0000
FEMALETEACHERPERCENTAGE	-0.00607	-0.557	0.5779
FEMALEWORK	-0.10419***	-8.74401	0.0000
AVERAGEHOUSEHOLDSIZE	-1.1365***	-10.7998	0.0000
SCHOOLINFRAINDEX	0.031564	1.234474	0.2178
NOOFSCHOOLS	-1.07E-05***	-4.80316	0.0000
INFLATIONRATE	-0.13598	-1.44946	0.1481
R-squared	0.289354		
Adjusted R-squared	0.27334		
F-statistic	18.06821		
Prob(F-statistic)	0.0000		

***, **, * represents statistical significance of 1%, 5%, 10% respectively.

Table 5 represents the results of the regression analysis of the primary gender gap showing significant aspects regarding the socioeconomic and educational factors of the disparity of gender equity in the foundational level of states in India. The explanation of the variation in the regression analysis of the primary gender gap is approximately 29% ($R^2 = 0.289$), and the F-statistic is significant with a p-value of 0.0000.

The most important determining variable is the rate of female literacy, which displays a strong negative influence of -0.09236 and a significant probability level of 0.0000, suggesting that an increase in female literacy significantly helps to close the gender gap in primary schooling. Correspondingly, female participation in the labour force displays a negative influence of -0.104 with a significant probability level of 0.0000, suggesting that female participation in the labour force helps to increase the opportunities of her daughters to attend primary education. The average household size displays a negative influence of -1.136 with a significant probability level of 0.0000. Per capita income displays a significant positive influence on reduced gender inequality in primary schooling ($p = 0.0039$).

It indicates that the share of female teachers, as well as inflation, are statistically insignificant, and school infrastructure has no direct effect, although the number of schools has a strong significant effect of $-1.07E-05$ with a significant value of 0.0000. It again illustrates the significance of school accessibility. The results re-emphasize that women's

education, economic engagement, household, and school accessibility have the most significant role to reduce gender inequality at the primary level.

Table 6:Upper primary Gender Gap

Variable	Coefficient	t-Statistic	Prob.
C	4.722398	1.327348	0.1852
AVERAGEHOUSEHOLDSIZE	-0.594139**	-2.195572	0.0288
FEMALELITERACY	-0.155570***	-7.499623	0.0000
FEMALETEACHERPERCENT	0.006798	0.375009	0.7079
FEMALEWORK	-0.100306***	-3.936933	0.0001
INFLATIONRATE	-0.060910	-0.456482	0.6483
PERCAPITAINCOMEINR	-7.82E-06*	-1.755157	0.0801
NOOFSCHOOLS	-2.16E-07	-0.127084	0.8989
SCHOOLINFRAINDEX	0.175593***	4.458709	0.0000
R-squared	0.321412		
Adjusted R-squared	0.306120		
F-statistic	21.01816		
Prob(F-statistic)	0.000000		

***, **, * represents statistical significance of 1%, 5%, 10% respectively.

Table 6 represents results from the regression analysis on the upper primary gender gap provide evidence on factors that remarkably affect gender inequality in the mid-years of education in Indian states. The equation explains a study on 30% of the upper primary gender gap ($R^2 = 0.304$) due to it being statistically significant overall (p value in F-statistic: 0.0000). This is an indication of

adequate explanatory power in the study done in the context of panel regressions. The female literacy variable is a strongly negative factor qualitatively (coefficient: -0.1556; p-value: 0.0000). This is an indication that states/regions showing higher female literacy achievements will help decrease gender inequality in education to meet an incentive for girls to also pursue education. The factor of female labor force participation also diminishes gender inequality in education (coefficient: -0.100; p-value: 0.0001). The average size of households acts negatively significant at 5% .

However, the proportion of female teacher is not significant, and this is reflected in the school infrastructure index, which shows a significantly positive coefficient of 0.1755, 0.0000, this indicates that Accessibility and Safety play an important role and could be used to reduce differences between genders.. The number of schools shows a insignificantly negative impact of -0.2156, 0.8989. The effect of both Per capita income and Inflation has also remained constant in showing insignificance. The following are the interpretations of the findings: The equality of genders at the Upper Primary Level is greatly dependent on the literacy rate and participation rate of females in the economy, household, and school infrastructure, and that no. of schools plays a less significant role.

Table 7:Secondary Gender gap

Variable	Coefficient	t-Statistic	Prob.
C	-1.082655	-0.347219	0.7286
AVERAGEHOUSEHOLD SIZE	2.520984	5.359449	0.0000
FEMALE LITERACY	-0.271503	-10.1789	0.0000
FEMALE TEACHER PERCENTAGE	0.069434	3.014768	0.0028
FEMALE WORK	-0.199514	-6.672512	0.000
INFLATION RATE	-0.02065	-0.214233	0.8305
PER CAPITA INCOME IN R	-1.01E-05	-1.056018	0.2917
NO OF SCHOOLS	-1.57E-05	-5.102553	0.0000
SCHOOL INFRA INDEX	0.194614	5.246964	0.0000
R-squared	0.371800		
Adjusted R-squared	0.357644		
F-statistic	26.26366		

Prob(F-statistic)	0.000000		
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***, **, * represents statistical significance of 1%, 5%, 10% respectively.

Table.7 represents the regression analysis of the secondary gender gap reveals the significant factors affecting the gender disparity in Indian states. The regression model explains approximately 37% of the variation in the secondary gender gap ($R^2 = 0.371$). It is significant at the overall level (F-statistic $p = 0.0000$). Female literacy is found to be significantly negatively affecting the gender gap at the secondary level (-0.271 , $p = 0.0000$). This suggests that higher female literacy is associated with reduced gender gaps at the secondary level. Female work force participation is also found to significantly impact the reduction of the gender gap (-0.199 , $p = 0.0000$). Average size of households is found to significantly affect the gender gap (2.520 , $p = 0.0000$). This indicates that an increase in average household size is associated with a higher gender gap in enrolment.

The proportions of female teachers are highly significant with a coefficient of (0.069 , $p = 0.0028$). Again, the school infrastructure index positively contributes with a highly significant coefficient of 0.1946 ($p = 0.0000$), although this might not suffice in treating the gender issue and might work mostly in favor of boys as well as providing them with better infrastructure facilities in and around school environments. The effect of the school count is negative and significant with a coefficient of ($-1.57E$, $p = 0.0000$). Per capita income and inflation are small and significant with negative effects, respectively. This study makes it clear that infrastructure is of less importance in closing secondary-level gaps in the gender gap phenomenon and instead stresses the importance of female literacy rates and workforce participation rates and school and teacher availability rates in the same phenomenon.

Table 8: Higher Secondary Gender Gap

Variable	Coefficient	t-Statistic	Prob.
C	-0.421036	-0.120376	0.9043
AVERAGEHOUSEHOLD SIZE	3.228199***	5.768271	0.0000
FEMALE LITERACY	-0.149519***	-6.348364	0.0000
FEMALE TEACHER PERCENTAGE	-0.076201***	-4.048723	0.0001
FEMALE WORK	-0.047140	-1.605042	0.1094

INFLATIONRATE	0.141230	1.058892	0.2904
PERCAPITAINCOMEINR	-1.84E-05***	-2.772058	0.0059
NOOFSCHOOLS	-2.65E-05***	-9.482645	0.0000
SCHOOLINFRAINDEX	0.039616	0.857463	0.3918
R-squared	0.454083		
Adjusted R-squared	0.441780		
F-statistic	36.91019		
Prob(F-statistic)	0.000000		

***, **, * represents statistical significance of 1%, 5%, 10% respectively.

Table 8 represents the regression equation for the higher secondary gap of the regression analysis indicates relevant factors of gender disparity in Indian states. In the model, the explanatory factors account for about 45% of the variation in the higher secondary gap of gender disparity ($R^2 = 0.454$). This model is statistically significant as a whole because the F-statistic probability is 0.0000. Results indicate an extremely significant negative relationship between female literacy and the higher secondary gap of gender disparity (-0.1495 , $p = 0.0000$). This verifies that greater female participation in higher education results in further closing of the gap at this level of education. Female teachers contribute significantly in closing this gap because of safe environments of motivation and inspiration for girls at the secondary level of education (-0.0762 , $p = 0.0001$).

The presence of schools is a significant variable, and the number of schools exerts a strong negative impact ($-2.65E$, $p = 0.0000$) to bridge the gap. The average size of the household is also a significant factor that higher the gap (3.2281 , $p = 0.0000$) for females, and per capita income also has a small but negative influence. It is observed that the school infrastructure index, female employment, and inflation rate are statistically insignificant, implying that societal norms and ease of accessibility play a much larger role in the higher secondary level of schooling.

5. Conclusion and Recommendations:

The study used state-level panel data from the primary, upper primary, secondary, and higher secondary levels to examine the gender inequality in education trends in the Indian states

from the year 2011-12 to 2024-25. Based on the results, it is revealed that gender inequality in Indian primary education is substantially narrowed down due to the efforts of the Indian Government in the Mid-Day Meal Scheme, provision of free textbooks, provision of uniforms, and accessibility. Girls are on par or even better than boys in elementary education. However, the same is not observed in higher levels of education; gender inequality is huge, particularly at the secondary, higher secondary levels.

According to the econometric analysis, an important factor that helps to narrow down gender disparities in all levels of education is female literacy. Because educated mothers also play an important role in educating girls, gender disparities are smaller in countries that have higher female literacy levels. Another important factor is female labor force participation, as it implies that if female respondents are actively engaged within the labor market, it leads to an increased ability to take part within a household's decision-making processes, which has a positive effect on girls' educational achievements. Finally, access to schools helps to narrow down gender disparities, as it re-emphasizes that it is important to be accessible, particularly to girls during adolescence when living in remote areas.

By improving security, serving as role models, and promoting a conducive learning environment, the contribution made by female teachers is pivotal in fostering gender parity in second-level and higher secondary education. Although the influence of school infrastructure positively contributes to attendance, the effect on gender inequality remains inconclusive, implying that the problem cannot be removed by the infrastructure. The effect of inflation on attendance does not influence the learning environment, whereas the effect of per capita income has a faint positively significant influence.

The above results indicate a number of policies which need to be formulated. Firstly, and especially in the state where there is an imbalance in the number of females who are literate, there needs to be a focus on improving the literacy of females through adult and further education programs. Secondly, given that the economic empowerment of females creates a multiplier effect for the female education, there needs to be a focus on policies related to improving the working opportunities of females and a safe working environment. Thirdly, in order to ensure that the number of dropouts in the female sector is controlled, there needs to be an augmentation in the number of secondary and higher secondary institutions, specifically in the less-privileged sections of society. Fourthly, there also needs to be a focus on policies related to the aforementioned female-related social aspects, such as early-age marriage, security, and patriarchy, specifically through public awareness and intervention.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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