Growth and Changes in Female Literacy and Sex Ratio in Bhagalpur District, Bihar, India.

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Abstract

Literacy, a key indicator of human development, influences population attributes such as fertility, mortality, migration, and gender balance. Low female literacy often reflects socio-cultural constraints, neglect of girl children, and gender-biased practices, which in turn affect sex ratios. This study examines the relationship between female literacy and sex ratio in Bhagalpur district, Bihar, highlighting the socio-demographic implications of educational attainment. Using secondary data from census records, this study identifies blocks with low female literacy and employs Pearson correlation analysis to determine the association between literacy rates and sex ratio. The findings underscore that improving female literacy not only enhances educational outcomes but also contributes to better sex ratios, reduced gender discrimination, and overall social development. Regular monitoring and policy implementation are essential to achieve equitable and sustainable progress.

Keywords: Female Literacy Rate, Sex Ratio, Growth, Decadal Changes, Social Development

I. INTRODUCTION

Literacy and sex ratio are widely recognised as crucial indicators of social development and gender equity. Literacy, especially female literacy, extends beyond educational attainment to influence women's empowerment, economic participation, and improvements in family health and social well-being. In parallel, the sex ratio, defined as the number of females per thousand males, reflects demographic balance and reveals underlying gender relations, cultural practices, and socio-economic conditions. Together, these indicators provide a mirror of the status of women within society. In India, literacy has increased significantly over the past decades; however, sharp gender disparities persist, with female literacy still lagging behind male literacy, particularly in rural and semi-urban areas. The sex ratio, too, has shown regional variations, with the child sex ratio raising serious concerns about gender discrimination and patriarchal norms. Bihar, one of India's socio-economically backwards states, reflects these challenges in a more pronounced manner. Bhagalpur district in eastern Bihar serves as an important case for examining these issues. Despite gradual improvements in literacy levels, the gender gap remains substantial. Similarly, fluctuations in the overall and child sex ratios highlight the persistence of socio-cultural barriers, making the study of literacy and sex ratios vital for understanding gender equity in the region.

II. LITERATURE REVIEW

These studies together provide a theoretical and empirical foundation for examining the relationship between female literacy and sex ratio. It is the backbone of any empirical work and presents a scan of related literature about the study.

Clarke (1960) highlighted the demographic determinants of sex ratio, identifying birth ratio, mortality differentials, and migration as its core drivers. Building on this, **Sen (1990),** in his seminal work *"More than 100 Million Women are Missing"*, emphasised that skewed sex ratios serve as clear evidence of systemic gender discrimination rooted in practices such as infanticide and neglect. In the context of education, **Kingdon (2002)** explored gender inequality in India and argued that socio-cultural norms significantly restrict female participation in schooling, thereby perpetuating educational disparities. Similarly, **Shinde (2015)** explores the correlation between female literacy and child sex ratio in Satara District, Maharashtra, focusing on the role of literacy in societal development. **Singh (2016)** attempts to determine the spatial patterns of female literacy and economic development in India. Higher female literacy rate districts are noted for lower proportions of poor populations. **Katiyar (2016)** analyses gender disparity in literacy across India, highlighting a significant

gap between male and female literacy rates, with rural areas showing more disparity, and concludes that focusing on female literacy is crucial to address this issue. **Malik et al. (2019)** examine the correlation and comparison between sex ratio and literacy rate in Hooghly district, West Bengal, finding an upward trend in sex ratio and identifying traditional superstitions and discrimination as major obstacles to improvement. **Sidkar (2020)**, this study compares male and female literacy rates in the Mithila region from 1961 to 2001, highlighting the impact of female literacy on economic and social development. **Solanke & Khadke (2022)** investigate the correlation between urban literacy rates and urban sex ratios in the Parbhani district, analysing changes from 1991 to 2011 using census data and statistical methods. **Adhikari (2025)** examines the correlation between literacy and population growth in Malda District, finding a strong negative correlation indicating that higher literacy rates are associated with lower population growth rates.

III. STUDY AREA

Bhagalpur district, located in the eastern part of Bihar, lies between 25°07′– 25°30′ N latitude and 86°37′– 87°30′ E longitude. It covers an area of about 2,569 sq. km and comprises both urban and rural settlements. The district is bordered by Munger in the west, Godda (Jharkhand) in the south, and Katihar and Purnea in the east. According to the Census of India 2011, the district had a total population of 3.03 million, of which 1.43 million were females, accounting for nearly 47 per cent of the total. The overall literacy rate was 63.1percent, with female literacy (52.2 per cent) significantly lower than male literacy (73.3 per cent). The sex ratio stood at 880 females per 1,000 males, reflecting gender imbalances in demographic composition.
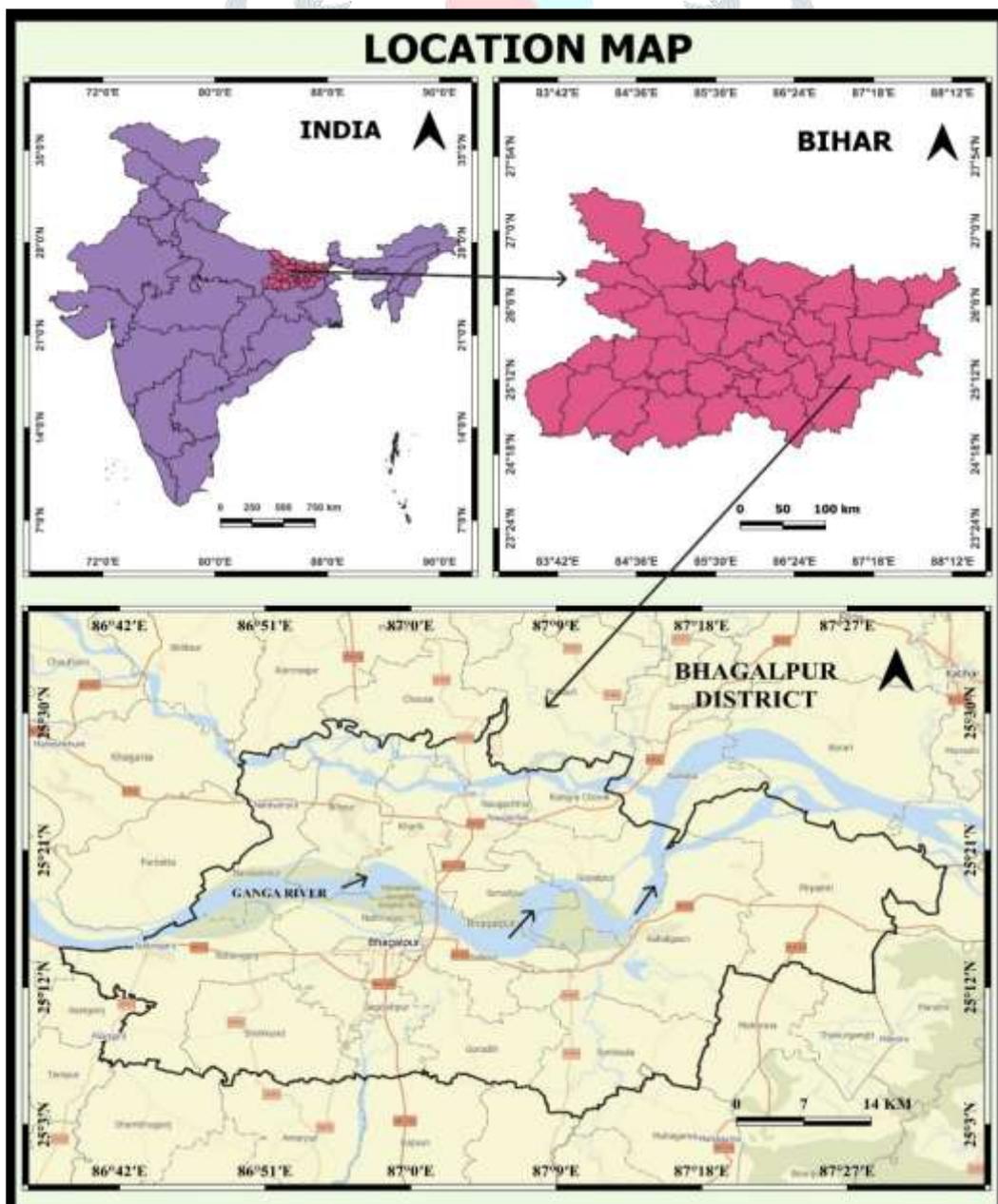

Figure 1: Location map of the study area

IV. OBJECTIVE OF THE STUDY

The present study has been undertaken with the following objective:

- To analyse the decadal growth of female literacy from 2001 to 2011.
- To study the changes in sex ratio, during the same period.
- To find out the relationship between female literacy and sex ratio in the study area.

V. DATASOURCE & METHODOLOGY

The present study is based entirely on secondary data obtained from the Census of India (2001 and 2011), the District Census Handbook of Bhagalpur, and other government reports. Female literacy rate and sex ratio have been considered as the primary indicators for analysis. Simple statistical tools, including percentages, growth rates, and the Karl Pearson correlation test, were employed to examine the relationship between literacy and sex ratio. Additionally, graphs, charts, and maps were prepared using Excel and QGIS to visually represent trends and spatial patterns. The study focuses on the period 2001–2011, aiming to highlight recent changes, disparities, and challenges in female literacy and sex ratio across Bhagalpur district.

VI. RESULT AND DISCUSSION

6.1. Decadal Growth of Female Literacy (2001- 2011)

The female literacy scenario in Bhagalpur district witnessed a significant rise during 2001–2011, reflecting the impact of educational programmes and increasing awareness towards women's education. While the overall literacy improved, wide spatial disparities persisted between urban and rural blocks, influenced by socio-economic conditions, infrastructure, and cultural factors. This growth also suggests a gradual narrowing of the gender gap, though challenges remain in achieving parity, as shown in Table 1.

Table 1: Decadal changes in female literacy rate in Bhagalpur district (2001-2011)

Sl. No.	Blocks	Female Literacy Rate (2001)	Female Literacy Rate (2011)	Decadal Changes (%)
1.	Narayanpur	31.26	50.03	18.77
2.	Bihpur	35.97	52.21	16.24
3.	Kharik	29.72	48.92	19.20
4.	Naugachhia	36.11	55.03	18.92
5.	RangraChowk	33.83	46.14	12.31
6.	Gopalpur	29.75	55.34	25.59
7.	Pirpainti	32.54	47.62	15.08
8.	Colgong	37.52	51.08	13.56
9.	Ismailpur	21.72	40.46	18.74
10.	Sabour	37.52	61.27	23.75
11.	Nathnagar	42.00	52.86	10.86
12.	Sultanganj	37.41	58.54	21.13
13.	Shahkund	37.11	53.68	16.57
14.	Goradih	32.57	47.70	15.13
15.	Jagdishpur	47.91	68.53	20.62
16.	Sonhaula	32.62	44.30	11.68
Bhagalpur District		**38.10**	**54.89**	**16.79**

Source: District Handbook of Bhagalpur District (2001 & 2011)

The analysis of female literacy in Bhagalpur district between 2001 and 2011 from as shown in Table 1, reveals a remarkable improvement from 38.10 per cent to 54.89 per cent, registering a decadal growth of 16.79 percentage points. However, the progress has not been uniform across blocks. The highest gains were recorded in Gopalpur (25.59%), Sabour (23.75%), Sultanganj (21.13%), and Jagdishpur (20.62%), indicating the positive influence of better educational facilities, urban proximity, and awareness programmes. Moderate improvements were also observed in Narayanpur, Kharik, Naugachhia, and Ismailpur, where female literacy increased by around 18–19 per cent. On the other hand, blocks such as Nathnagar (10.86%), Sonhaula (11.68%), and Rangra Chowk (12.31%) showed comparatively lower increments, pointing towards persistent socio-economic barriers, inadequate educational infrastructure, and gender-related constraints. This uneven pattern clearly highlights the spatial disparities in literacy development within the district. Overall, the findings confirm that although female literacy has advanced considerably during the decade, targeted interventions are still required in the lagging blocks to ensure balanced and inclusive educational growth.
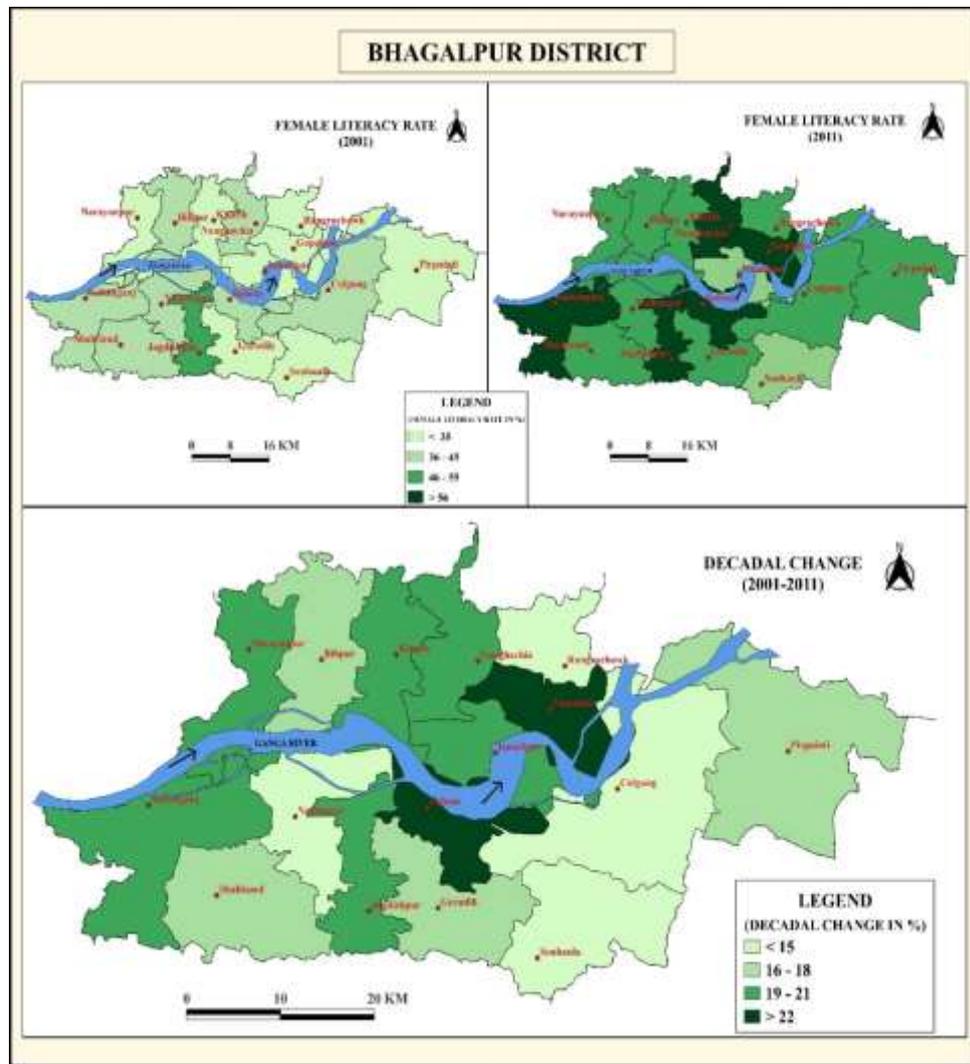
Figure 2: Decadal Changes in Female Literacy Rate (2001- 2011)

6.2. Changes in Sex Ratio (2001- 2011)

The sex ratio in Bhagalpur district showed moderate improvement between 2001 and 2011 in Table 2, indicating gradual progress in demographic balance. This positive change reflects the combined impact of rising female literacy, better health awareness, and government initiatives aimed at women's and children's welfare. However, block-level variations remain, with some rural and socio-economically weaker areas continuing to record lower sex ratios compared to urban centres.

Table 2: Decadal Changes in Sex Ratio in Bhagalpur District (2001-2011)

Sl. No.	Blocks	2001	2011	Decadal Change (%)
1.	Narayanpur	881	868	-1.47
2.	Bihpur	871	879	0.92
3.	Kharik	880	875	-0.57
4.	Naugachia	864	879	1.74
5.	RangraChowk	861	872	1.28
6.	Gopalpur	875	876	0.11
7.	Pirpainti	875	871	-0.46
8.	Colgong	868	872	0.46
9.	Ismailpur	877	866	-1.25
10.	Sabour	863	880	1.97
11.	Nathnagar	876	883	0.80
12.	Sultanganj	876	889	1.49
13.	Shahkund	895	880	-1.68
14.	Goradih	872	882	1.15
15.	Jagdishpur	873	886	1.49
16.	Sonhaula	912	900	-1.32

Bhagalpur District	876	880	0.46

Source: District Handbook of Bhagalpur District (2001 & 2011)

The analysis of sex ratio in Bhagalpur district between 2001 and 2011 reveals a marginal overall improvement, rising from 876 to 880 females per 1,000 males, indicating a decadal increase of only 0.46 per cent. However, this aggregate figure masks significant block-level variations. Positive growth in sex ratio was observed in blocks such as Sabour (+1.97%), Naugachhia (+1.74%), Sultanganj and Jagdishpur (+1.49% each), Rangra Chowk (+1.28%), and Goradih (+1.15%). These areas reflect a comparatively better gender balance, possibly linked to improved awareness, access to education, and health facilities. Conversely, a declining trend was noted in Shahkund (−1.68%), Sonhaula (−1.32%), Narayanpur (−1.47%), and Ismailpur (−1.25%), which indicates persistent socio-cultural biases and inadequate female survival chances. The data further suggests that urban and peri-urban areas, such as Sabour and Nathnagar, witnessed more favourable changes than remote rural blocks, underscoring the role of urbanisation, education, and health access in shaping demographic outcomes. Despite some local gains, the overall slow pace of improvement points to the continuing challenge of gender imbalance in Bhagalpur, necessitating more focused interventions in lagging rural blocks.
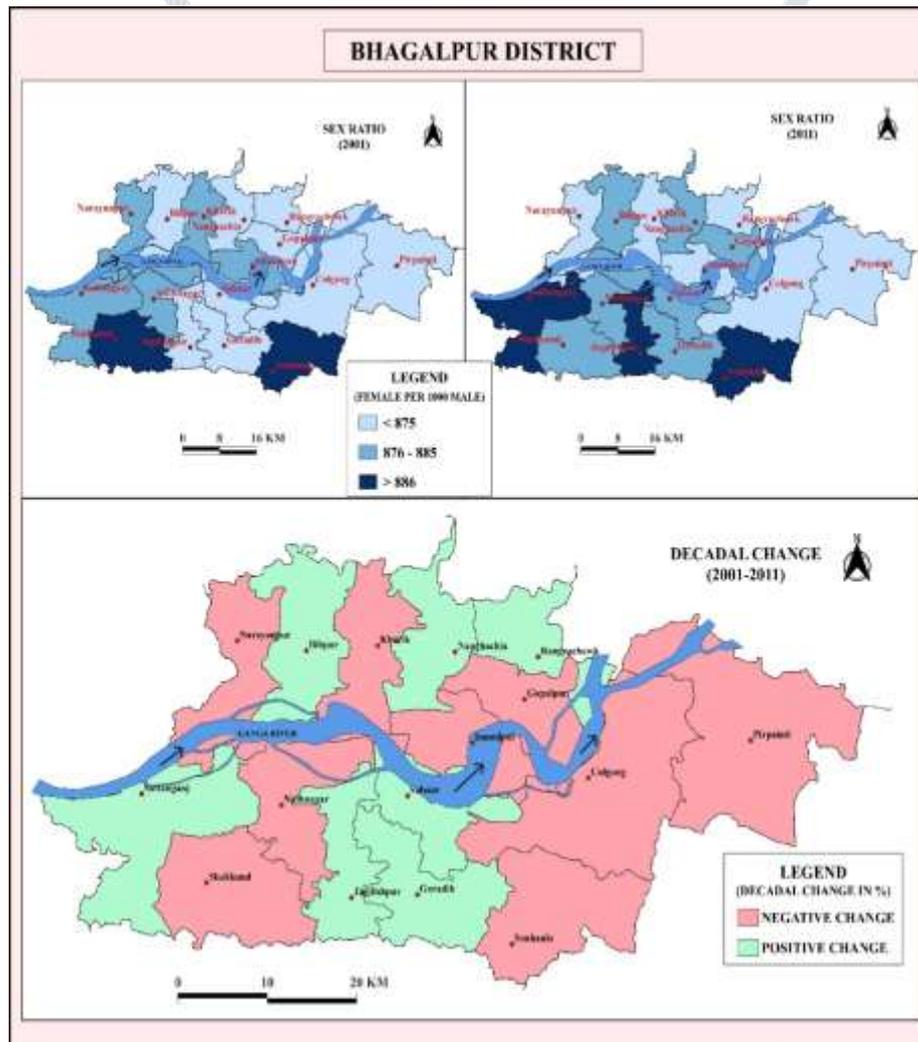

Figure 3: Decadal Changes in Sex Ratio (2001- 2011)

6.3. Relationship between Female Literacy Rate & Sex Ratio

To fulfil the third objective, a hypothesis has been formulated to examine the relationship between female literacy and sex ratio in Bhagalpur district. The analysis is based on block-level data for the years 2001 and 2011. Since both indicators reflect important aspects of gender development, their correlation is expected to provide insights into how educational attainment among women influences demographic balance.

➢ **Null Hypothesis (H₀):** Female literacy rate does not significantly influence sex ratio in Bhagalpur district across the decades 2001–2011.

➢ **Alternate Hypothesis (H₁):** Female literacy rate significantly influences sex ratio in Bhagalpur district across the decades 2001–2011.

The normality of the data was examined using the Kolmogorov–Smirnov and Shapiro–Wilk tests for both decades (2001 and 2011). For **female literacy rate (2001)**, the p-values were 0.127 and 0.459, while for **female literacy rate (2011)**, the p-values were 0.200 and 0.826, all of which are greater than 0.05. Hence, the

assumption of normality was satisfied, and parametric tests such as Pearson's correlation were applied to assess the strength and direction of the relationship between female literacy and sex ratio across the blocks of the district.

Table 3: Correlation between Female Literacy and Sex Ratio in Bhagalpur District (2001 & 2011)

Year	Variables	Number	Pearson Correlation (r)	Sig. (p-value)
2001	Female Literacy (2001) & Sex Ratio (2001)	16	-0.159	0.558
2011	Female Literacy (2011) & Sex Ratio (2011)	16	0.317	0.232

Source: IBM SPSS Statistics 27.0.1

The results are summarised in Table 3. In 2001, the correlation between female literacy and sex ratio was weakly negative ($r = –0.159$) and statistically insignificant ($p = 0.558$). This indicates that higher female literacy levels were not associated with improvements in the sex ratio during that year. In contrast, the 2011 analysis showed a weak positive correlation ($r = 0.317$) between female literacy and sex ratio, though the relationship again remained statistically insignificant ($p = 0.232$).

These findings suggest that the null hypothesis could not be rejected in either decade. However, the change in the direction of the relationship from negative in 2001 to positive in 2011 points to a gradual shift in the socio-demographic dynamics of the district. While female literacy alone may not have had a statistically measurable impact on the sex ratio, its rising levels appear to be aligning more positively with gender equity over time, indicating the possibility of stronger associations in the future.

VII. SUGGESTION

To improve female literacy and promote gender equity in Bhagalpur district, targeted educational programs should focus on blocks with persistently low female literacy, such as Ismailpur, Kharik, and Gopalpur. This can be achieved by enhancing school infrastructure, providing scholarships, and implementing adult literacy initiatives to ensure learning opportunities for all age groups. Complementing these efforts, gender awareness campaigns should be organised to challenge traditional biases, discourage early marriage, and foster community support for the education and well-being of girl children. Additionally, socio-economic support measures, including conditional skill development programs and livelihood opportunities for women, can strengthen their social and economic status, thereby creating an enabling environment for sustained educational attainment. Finally, consistent policy monitoring at the block level is essential to track trends in literacy and sex ratio, identify gaps, and ensure the equitable implementation of interventions across the district.

VIII. CONCLUSION

In conclusion, improving female literacy and promoting gender equality in Bhagalpur district requires a comprehensive approach. Focusing on blocks with low female literacy through better school infrastructure, scholarships, and adult education can increase learning opportunities. At the same time, awareness campaigns can help challenge traditional gender biases and reduce early marriage. Socio-economic support for women through skill development and livelihood programs can further strengthen their status in society. Regular monitoring of literacy and sex ratio trends is also essential to ensure that interventions are effective and reach those who need them most. Overall, a combined effort in education, awareness, and empowerment can lead to significant improvements in female literacy and gender equity in the district.

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