Quest Journals
Journal of Research in Humanities and Social Science
Volume 14 ~ Issue 4 (April 2026) pp: 109-120
ISSN(Online):2321-9467
www.questjournals.org

Research Paper

Spatial Inequality in Educational Infrastructure: A Block Level Study of Prayagraj District, Uttar Pradesh

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Abstract: *Education plays a crucial role in the overall development of anindividual's capacity and enhances their avenues for greater participation in social and economic development. The present study aims to assess the availability of educational infrastructure at the block level in the Prayagraj district. To assess the availability of educational infrastructure, UDISE+ data (2021-2022) and the District Census Handbook (Census, 2011) have been used. A total of nine parameterswere used to conduct this study: four related to the proportion of schools available at the block level in the district, and the remaining five to the percentage of schools with amenities present at the block level in the district. To analyse regional variation in both groups of parameters across different blocks, the Z-score method and the composite Z-score index have been applied so that the parameter values across blocks are standardised, making comparison easier. Further, the composite Z-score is classified into three groups, namely low, medium, and high. Blocks have been classified and mapped according to their composite Z-score index value in these groups. The findings of this study show that there exists high regional variation in the availability of educational infrastructure in different blocks of the Prayagraj district.*
Keywords: *Education,Availability of Schools,Spatial inequality, Prayagraj.*

Received 08 Apr., 2026; Revised 12 Apr., 2026; Accepted 18 Apr., 2026 © The author(s) 2026. Published with open access at ***www.questjournals.org***

I. Introduction

Education is a vital indicator of a nation's socio-economic development. It empowers individuals, shapes societies, and fosters innovation. From birth, we begin to learn, and throughout life, education remains essential in shaping our identities and potentials (Sen, 1999; UNDP, 2016). Human Capital Theory asserts that investing in education enhances individual productivity and skills, thereby supporting overall national growth (Becker, 1993). Similarly, the Capability Approach emphasises that education broadens individuals' freedom to pursue a better life (Sen, 1999). Consequently, equitable access to education is crucial for the sustainable development of both individuals and society (Tilak, 2002; Tilak, 2011). However, the benefits of education depend not only on enrolment but also on the availability and quality of educational infrastructure. Educational infrastructure encompasses school buildings, classrooms, libraries, teachers, sanitation facilities, electricity, laboratories, and internet connectivity. Adequate infrastructure creates a conducive learning environment, boosts student attendance, and improves learning outcomes, while poor infrastructure limits educational opportunities and hampers performance (Earthman, 2002; World Bank, 2018). Despite numerous government initiatives, disparities in Educational access and infrastructure persist across many regions, especially in developing countries like India (Tilak, 2002; Dreze and Sen, 2013). Educational facilities are often unevenly distributed across regions, which leads to spatial inequality in access to educational opportunities. Studies suggest that the high number of dropouts is due to the lack of educational infrastructure, though the situation is more depressing in the lower levels of administrative divisions. In order to improve such a situation, the availability of equitable educational facilities is essential. Poor access to educational opportunities greatlyimpacts low-income families because the children of such families are more likely to drop out when adequate educational opportunities are absent (Sharma and Patil, 2022).Spatial inequality refers to the uneven distribution of facilities and services across different geographical regions, resulting in disparities in development outcomes (Morton, 2007; Soja, 2010**).** In the context of education, spatial inequality reflects differences in the availability and accessibility of educational facilities among regions **(**Kumar & Rai, 2014**).** These inequalities are often visible between rural and urban areas as well as between regions with varying socio-economic characteristics **(**Siddiqui & Ahmad, 2017**).**

As the nation embarks on the journey towards achieving universal elementary education, the government has launched various schemes to make education affordable and accessible for all sections of society, such as the Mid-Day Meal Scheme (1995) and Sarva Shiksha Abhiyan (2001). Additionally, many educational reforms have been launched in India during the last few decades to abridge socio-economic and spatial inequalities in access to education. Another initiative taken bythegovernment is Samagra Shiksha Abhiyan (2018), which aims to improve access, equity, and quality of education across the nation (Ministry of Education, 2020). In India, through the Right of Children to Free and Compulsory Education (RTE) Act, 2009, education has been given the status of a fundamental right. This act prescribes minimum norms for school infrastructure and facilities in order to ensure equitable access to education. According to the UDISE+ report (2021-2022), India has more than 1.49 million schools serving approximately 265 million students, representing one of the largest education systems in the world (Ministry of Education, 2022). Despite this large educational network, inequalities in educational infrastructure remain evident across states and regions (Tilak, 2018); Kingdon, 2020).

Uttar Pradesh, due to its large population and socio-economic diversity, faces considerable challenges in ensuring the equitable distribution of educational facilities. Although the state has an extensive network of schools, exceeding 2.5 lakh institutions, variations in their spatial distribution across rural and urban regions remain significant (Government of Uttar Pradesh, 2022; Singh & Sharma, 2019).At the district level, Prayagraj district exhibits considerable diversity in settlement patterns and levels of socio-economic development across its administrative blocks. Urban areas generally enjoy better access to educational infrastructure, while several rural blocks continue to face deficiencies in basic educational facilities. Such disparities highlight the importance of examining the spatial patterns of educational infrastructure to identify regions that are underserved **(**Ahmad & Siddiqui, 2018).Therefore, analysing the spatial distribution of educational infrastructure is essential to identify regions with infrastructural deficits as well as those with adequate facilities. Such analysis helps in promoting balanced regional development and equitable educational opportunities. In this context, the objectives of the present study are to examine the availability of educational infrastructure in different blocks of Prayagraj district and to assess spatial inequality in the availability of educational infrastructure at the block level in Prayagraj district.

II. Literature Review

Empirical studies demonstrate that there exists a strong relationship between educational attainment and economic development. This relationship indicates that countries with higher levels of educational attainment tend to achieve greater productivity and improved living standards. It is also evident that countries with higher levels of economic development generally possess stronger educational systems, suggesting a mutually reinforcing relationship between education and development **(**Barro & Lee, 2013; Hanushek &Woessmann, 2012**).** Furthermore, the development of education within a region plays an important role in promoting intergenerational mobility, as it improves employment opportunities and enhances income levels **(**Chetty et al., 2014; World Bank, 2018).However, it is also widely recognised that educational outcomes depend not only on access to schools but also on the quality and adequacy of educational infrastructure. School infrastructure includes classrooms, teachers, libraries, playgrounds, laboratories, and sanitation facilities such as toilets. These facilities play a crucial role in creating an effective learning environment. Empirical research suggests that improved school infrastructure contributes to higher student attendance and better academic achievement (Glewwe et al., 2011; Barrett et al., 2019; Kumar et al., 2024). In contrast, inadequate infrastructure results in overcrowded classrooms, poor learning conditions, and limited access to quality education. Such conditions are often observed in rural and economically disadvantaged regions where infrastructural investment is relatively limited (Tilak, 2018; Kingdon, 2020).

Spatial inequality refers to the uneven distribution of resources, services, and opportunities across geographical regions (Morton, 2007); Soja, 2010). In the context of education, spatial inequality manifests through variations in the availability of schools, infrastructure facilities, teacher availability, and accessibility across regions. Such inequalities are often associated with differences in socio-economic conditions, levels of urbanisation, and regional development patterns **(**World Bank, 2009). Geographers have emphasised that spatial factors such as location, accessibility, and regional socio-economic characteristics significantly influence educational outcomes **(**Fotheringham, Brunsdon, & Charlton, 2000). Studies have highlighted that rural areas and peripheral regions frequently face limited educational infrastructure and fewer institutional facilities compared with urban centres, leading to disparities in educational attainment(Agrawal, 2014;Mishra, 2023).

Recent spatial analyses have also highlighted the importance of geographic methods such as spatial autocorrelation and regional inequality indices in examining disparities in development indicators, including education (Anselin, 1995; Rey &Montouri, 1999). Such approaches reveal strong spatial clustering patterns, where neighbouring districts often exhibit similar levels of development due to shared socio-economic characteristics and regional policy effects. A large body of literature has examined the relationship between

educational infrastructure and student performance. Research suggests that the availability of adequate infrastructure significantly improves learning outcomes by creating a supportive learning environment. Facilities such as well-equipped classrooms, libraries, science laboratories, and digital resources help students access better learning opportunities and improve academic achievement (Barrett et al., 2019; Glewwe et al., 2011).

In India, considerable progress has been made in expanding educational access through policy initiatives such as Sarva Shiksha Abhiyan, the Right to Education Act (2009), and Samagra Shiksha Abhiyan. Despite these efforts, regional disparities in educational infrastructure remain a significant challenge (Tilak, 2002; Kingdon, 2020). Research indicates that educational inequalities persist across states, districts, and rural–urban areas due to differences in socio-economic development, population distribution, and public investment in education **(**Drèze & Sen, 2013; Singh, 2015). Studies have shown that many rural regions continue to experience shortages of classrooms, inadequate sanitation facilities, and limited digital infrastructure. Several scholars, including geographers, have examined the importance of education and regional variations in the development of educational infrastructure. Jhingran (2009) analysed disparities in key dimensions of educational development in India using DISE (2004–05) data to examine the effectiveness of the Sarva Shiksha Abhiyan (2001). Their study found that although all districts received increased investments in elementary education, relatively disadvantaged districts received proportionately higher allocations, which helped reduce access and infrastructure gaps and increased teacher recruitment. Kumari et al. (2020) examined the progress of educational attainment in India between 1991 and 2011 and found significant improvements across elementary, secondary, and higher education levels. The study highlighted a substantial increase in the number of individuals attaining elementary education during this period.

Studies conducted in Eastern Uttar Pradesh reveal that districts with weaker educational infrastructure often experience lower literacy rates, limited employment opportunities, and slower regional development. The uneven distribution of educational facilities contributes to broader regional inequalities in socio-economic development (Misra, 2024).At the state level, Kumar and Sinha (2011) analysed inter-district disparities in educational infrastructure in Uttar Pradesh. The authors used Maher's methodology to standardise indicators and applied principal component analysis to compute composite indices. Their findings suggest that although improvements in educational attainment have occurred, the pace of progress remains slower compared with several other Indian states. Tiwari (2021) examined the relationship between school resources and enrolment in elementary schools in Uttar Pradesh using a Tobit regression model. The study revealed that improved infrastructure attracts more students to schools. It also highlighted that school management factors such as teacher qualifications, vocational training for teachers, and the presence of female teachers positively influence student enrolment. Ashraf and Siddiqui (2013) examined the spatial dimension of educational and healthcare infrastructure in Western Uttar Pradesh and found significant regional disparities in social infrastructure distribution.

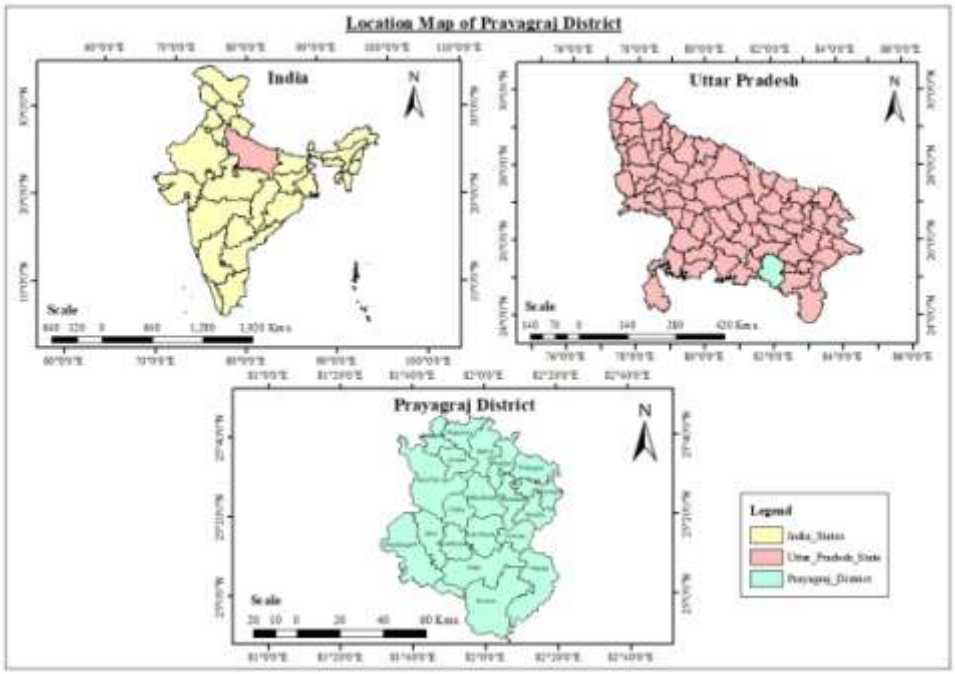
Similar studies have been conducted in other states of India. Naik et al. (2013) analysed regional disparities in educational development in Karnataka, Behl and Singh (2019)examined educational infrastructure disparities in Punjab, Hota (2023) studied regional inequality in educational development in Odisha, and Bhagwati et al. (2024) analysed educational infrastructure disparities in Assam. These studies collectively reveal that districts within states often exhibit significant variation in educational development, where some districts demonstrate considerable progress while others remain relatively underdeveloped. At the district level, several studies have examined spatial variation in educational development. Fatima et al. (2024) in Aligarh district of Uttar Pradesh, Hoque et al. (2020) in Uttar Dinajpur district of West Bengal, and Swarnkar and Gaurav (2019)in Jalore district of Rajasthan analysed spatial disparities in educational development at the block level. These studies applied Z-score and composite Z-score methods to measure levels of educational development and found substantial disparities among blocks within districts.

Although numerous studies have examined educational inequality and infrastructure development at national and state levels, relatively limited research has focused on intra-district spatial disparities, particularly at the block level. Many studies rely on state-level or district-level analyses, which often fail to capture variations within smaller administrative units. Block-level analysis is particularly important in geographically diverse districts such as Prayagraj, where variations in settlement patterns, socio-economic conditions, and accessibility can lead to unequal distribution of educational infrastructure. Therefore, a detailed spatial examination of educational infrastructure at the block level is necessary to identify localised disparities and guide targeted policy interventions.

III. Study Area

The present study has been carried out in the Prayagraj district of Uttar Pradesh, which is located between 24°47' N and 25°45' N latitude and 81°19' E and 82°21' E longitude. The district is bordered by Mirzapur and Sant Ravidas Nagar districts to the east, Jaunpur and Pratapgarh districts to the north, Kaushambi and Chitrakoot districts to the west, and Madhya Pradesh state to the south. Prayagraj covers a total

geographical area of 5,482 square kilometres. According to the 2011 census, the population of Prayagraj district is 5,954,391, with 4,481,518 people living in rural areas and 1,472,873 people residing in urban areas. The district's population has increased by 20.6% from 2001 to 2011. The population density is 1,086 people per square kilometre, with a density of 849 in rural areas and 7,258 in urban areas. The sex ratio in the district is 901 females for every 1,000 males; in rural areas, the sex ratio is 914, while in urban areas, it is 862. The literacy rate for the district is 72.3%, with a rural literacy rate of 68.8% and an urban literacy rate of 82.5%. Administratively, the district is divided into eight tehsils and 20 development blocks.



IV. Database And Methodology

In the present study, different data sources for the collection of secondary data have been used, a detailed description of which is given below. For the analysis of data,detailed methods have been used, the description of which is also given below.

Database

The present study is fully based on secondary sources of data, which have been collected from different sources i.e. UDISE+ (2021-22) and District Census Handbook of Allahabad (2011) and Census of India, 2011. Data ongeographical location, area of the district,total population, population density, literacy rate, sex ratio, and administrative division has been collected from District Census Handbook, while data of nine parameters which are going to be used in present research paper for analyzing of regional variation in education infrastructure in different blocks of the district, have been collected from UDISE portal. UDISE+ portal providesdata for schools and infrastructure, enrollment, and teachers at the state, district, and block levels.

Methods

In the present study, to study the regional variations in the availability of educational infrastructure in the blocks of Prayagraj district, a total of nine parameters have been selected, which have been further divided into two groups:

Proportion of schools (in Percentage) to total schools at the block level in Prayagraj district: 2021-22

- X1: Percentage of Primary Schools to Total Schools
- X2: Percentage of Upper Primary Schools to Total Schools
- X3: Percentage of Secondary Schools to Total Schools
- X4: Percentage of Higher Secondary Schools to Total Schools.

Percentage of schools with amenities present at the block level in Prayagraj district: 2021-2022

- X5: Percentage of Schools Having Functional Boys' Toilet
- X6: Percentage of Schools Having Functional Girls' Toilets
- X7: Percentage of Schools with Functional Drinking Water
- X8: Percentage of Schools with Functional Electricity

- X9: Percentage of Schools with Internet

For the analysis of regional variation in the availability of educational infrastructure, data from nine variables collected from the UDISE+ portal have been converted to a standardised form using the Z-score method and the composite Z-score method.The formula used for the calculation of the Z-score:

$$z_i = \frac{x_i - \bar{x}}{\sigma}$$

where Z_i stands for the Z-score of eachith variable, X_i stands for the observation value of ith variable, $\bar{x}$ stands for the mean value of each variable, and σ stands for the standard deviation of each variable.The formula used for the computation of the composite Z-score is:

Composite Z-score= $\frac{\sum z_{ij}}{N}$

In the above formula, Z_{ij} stands for the Z-score value of a variable i in block j, and N stands for the number of variables. To present the block-wise regional variation, blocks have been classified into five groups based on their composite Z-score. These groups are very low, low, middle, high, and very high. The spatial distribution of educational facilities has been presented by Thematic mapsprepared using ArcGIS 10.8 software.

V. Results And Discussions

Educational Status of Prayagraj District, 2011

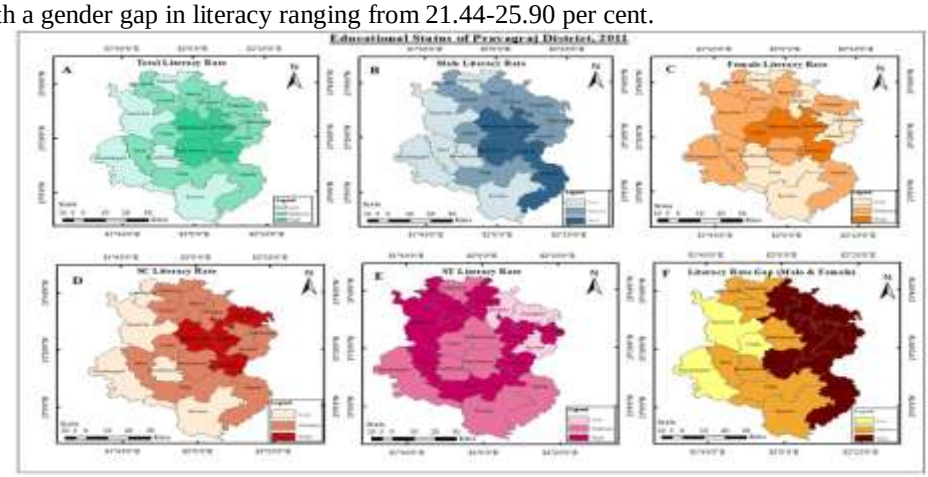
Table1 shows the educational status of the population across gender and caste in the Prayagraj district. It reveals that none of the blocks has a total literacy rate above the national average (74.04 per cent). The educational status of females and of the Scheduled Tribes is not at par with that of the total population (Maps 1C and 1E).Among Scheduled Tribes (ST), the highest literacy rates are observed inthe Baharia block (75 per cent), followed by the Soraon block (69.70 per cent). Furthermore, variation in literacy rates among ST is higher than that observed for the Scheduled Castes(SC) across the block of Prayagraj districts (Map 1D and 1E). Bahadurpur, Saidabad, Uruwan, and Pratappur blocks show high literacy rates among Scheduled Castes (60.59 per cent -65.88 per cent), while Holagarh, Kaurihar, Shankargarh, Kaudhiyara, and Koraon blocks have low levels of literacy rates among Scheduled Castes (51.72 per cent-55.88 per cent). Map (1E) presents the literacy rates among the Scheduled Tribes (ST) population across the blocks of Prayagraj district. Phulpur, Pratppur, and Handia blocks have low literacy rates (15.38 per cent), while Bahria, Holagarh, Soraon, Kaurihar, Jasra, Meja, Uruwan, Saidabad, and Dhanupur blocks have high literacy rates (52.27-75 per cent). The caste disparity in literacy rates can be explained through the lens of socio-economic and infrastructural factors.

Table 1: Literacy Rates across Blocks of Prayagraj District, 2011

Blocks	Total	Male	Female	SC	ST
Kaurihar	66.95	76.72	55.28	55.03	56.82
Holagarh	69.68	81.87	56.83	55.88	66.67
Mauaima	67.03	79.27	54.08	57.06	50.00
Soraon	69.76	81.84	56.56	58.18	69.70
Bahria	69.59	82.41	56.01	59.81	75.00
Phulpur	67.86	80.89	54.15	59.25	0.00
Bahadurpur	71.90	83.40	59.14	61.91	30.53
Jasra	67.65	78.99	55.02	57.23	55.66
Shankargarh	66.40	76.46	55.30	51.84	46.62
Chaka	69.69	79.79	58.62	59.92	41.11
Kaudhiyara	65.00	77.00	51.71	54.58	37.84
Karchhana	70.90	83.98	56.42	60.37	43.91
Pratappur	69.15	82.59	55.40	61.22	14.29
Dhanupur	68.44	82.38	54.06	59.89	57.35
Saidabad	71.48	84.13	57.58	62.08	60.66
Handia	68.33	82.49	53.30	59.21	15.38
Meja	67.59	79.99	54.09	58.23	57.31
Uruwan	72.79	86.37	58.25	65.88	57.89
Manda	70.03	83.32	55.40	60.59	52.27
Koraon	64.69	76.57	51.59	51.72	51.87
Total	**68.76**	**80.97**	**55.46**	**58.20**	**50.28**

Source: District Census Handbook, Prayagraj, 2011

Gender disparity in literacy rates is more prominent in the Prayagraj district (Maps 1B and 1C). Spatial pattern of male literacy rates indicates that Bahadurpur, Saidabad, Karchhana, Uruwan, and Manda blocks have a high level of male literacy (80.89 per cent-86.37 per cent); while Mauaima, Kaurihar, Jasra, Shankargarh, Kaudhiyara, and Koraon blocks exhibit low male literacy rates (51.59 per cent- 54.15 per cent). Female literacy rates across the blocks of Prayagraj district show an interesting picture (Map 1C). The literacy rates among females in all the blocks of Prayagraj are less than 60 percent. A few blocks, Chaka, Bahadurpur, Saidabad, and Uruwan blocks have a high level of female literacy rate (56.83-59.14 per cent). In Map 1(F), the literacy rate gap between males and females has been shown. Blocks located in the north-eastern and eastern parts of the district,such as Bahria, Phulpur, Pratappur, Saidabad, Dhanupur, Handia, Karchhana, Uruwan, and Manda, havea significantly high gender gap in literacy (25.90-29.19 per cent). Blocks located in the western part, i.e. Kaurihar, Chaka, and Shankargarh, show relatively lower gender gap in literacy (21.6-21.44 per cent); While Holagarh, Mauaima, Soraon, Bahadurpur, Jasra, Kaudhiyara, Meja, and Koraon blocks fall under the medium category, with a gender gap in literacy ranging from 21.44-25.90 per cent.



Map 1

Status of Availability of Schools in the Blocks of Prayagraj District

Table 2 presents the distribution of schools across different educational levels in the blocks of the Prayagraj districts. After examiningthe table, it is evident that, while the proportion of primary schools among all schools is high (over 40 per cent) in almost all blocks, the percentages of upper primary and secondary schools are low in every block compared to the proportion of primary schools. An interesting patternis shown in the relative proportion of secondary and higher secondary schools. The percentage of secondary schools is lowerthan the percentage of higher secondary schools in all the blocks of Prayagraj district. This might be due to the institutional practices of integrating secondary and higher secondary levels within the same schools rather than maintaining them as separate institutions.In spite of this, the percentage of higher secondary schools in the majority of the blocks is still quite low. This suggests a structural imbalance in the educational systemwhere access to higher education is comparativelylimited. It can be concluded that a relatively high proportion of primary schools is largely a result of concerted efforts from the government for promoting elementary education, whereas the low proportion of higher secondary schools may be attributed to higher financial cost, greater infrastructural requirements, and resource constraints. Consequently, these constraints, along with other socio-economic factors, result in a low proportion of higher secondary schools in all the blocks of Prayagraj district.

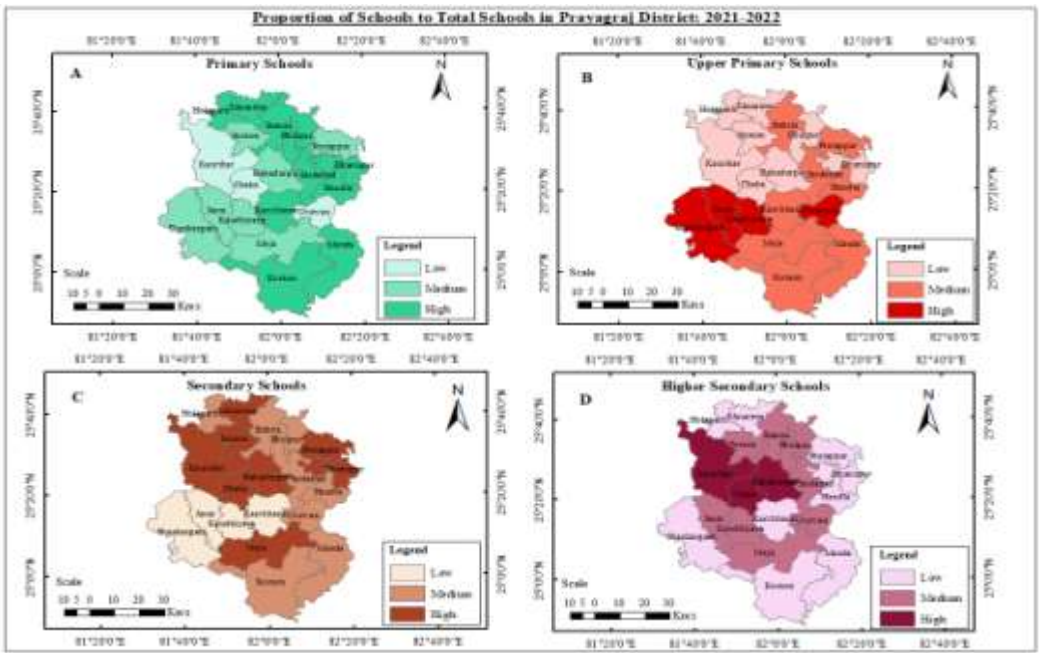
Table 2: Proportion of Schools to total Schools in Prayagraj District: 2021-2022

Blocks	Primary (X1)	Upper Primary (X2)	Secondary (X3)	Higher Sec (X4)
Kaurihar	44.93	28.99	9.06	17.03
Holagarh	55.73	29.17	6.25	8.85
Mauaima	51.60	29.79	9.04	9.57
Soraon	48.34	27.96	12.32	11.37
Bahria	51.15	31.92	6.54	10.38
Phulpur	50.96	28.74	7.28	13.03

Bahadurpur	47.20	28.32	8.74	15.73
Jasra	47.44	36.28	5.12	11.16
Shankargarh	48.52	38.15	4.81	8.52
Chaka	40.00	29.00	14.00	17.00
Kaudhiyara	49.15	35.59	4.52	10.73
Karchhana	53.65	31.39	5.11	9.85
Pratappur	49.44	33.09	8.92	8.55
Dhanupur	52.82	29.93	10.21	7.04
Saidabad	52.05	30.82	6.85	10.27
Handia	51.97	32.68	7.48	7.87
Meja	48.89	30.74	9.63	10.74
Uruwan	45.20	35.20	6.40	13.20
Manda	53.46	32.26	6.91	7.37
Koraon	52.17	32.74	5.88	9.21

Source: UDISE+, Department of School Education & Literacy, Ministry of Education, 2021-22

The spatial distribution of availability of primary, upper primary, secondary and higher secondaryschools in different blocks of Prayagraj district shows a contrasting picture (Map 2A, 2B,2C,2D)., while Holagarh, Mauaima, Bahria, Phulpur, Saidabad, Dhanupur, Handia, Karchhana, Manda, and Koraon blocks have high proportions (49.44 per cent-55.73 per cent) of primary schools to total schools (Map 2A), Kaurihar, Chaka, and Uruwan blocks have a low proportion (40 per cent- 45.20 per cent)



Map 2

Map 2B showsthe proportion of upper primary schools to total schools across the blocks of Prayagraj Districts. The spatial pattern reveals that Holagarh, Mauaima, Soraon, Kaurihar, Bahadurpur, Chaka, Phulpur, and Dhanupur blocks fall within the low proportion category (27.96-29.93 per cent), indicating relatively low availability of upper primary schools. In contrast, Jasra, Shankargarh, Kaudhiyara, and Uruwan blocks have high proportions (33.09-38.15 per cent), indicating better availability of upper primary educational institutions.Additionally, an intriguing spatial distribution is seen in the proportion of secondary schools to all schools (Map 1C).Blocks like Mauaima, Kaurihar, Soraon, Bahadurpur, Chaka, Pratappur, Dhanupur, and Meja have a significantly higher proportion (7.48-14.00 per cent) of secondary school facilities available in the Prayagraj districts, whereas blocks like Shankargarh, Jasra, Kaudhiyara, and Karchhana have a low proportion (4.52-5.12 per cent). The spatial distribution of the percentage of higher secondary schools to all schools in the Prayagraj district is presented on Map 2D. Blocks like Kaurihar, Chaka, and Bahadurpur have high proportions (13.20-17.03 per cent), but Holagrah, Mauaima, Pratappur, Dhanupur, Handia, Karchhana, Shankargarh,

Koraon, and Manda have low proportions (7.04-9.85 per cent), highlighting the limited presence of higher secondary institutions. The spatial distributions of different types of educational institutions show a progressive decline in the proportion of educational institutions from primary to higher secondary levels, indicating a structural imbalance in the distribution of educational facilities across the district.

Table 3presents Z-score values to standardisethe values of the parameters. To classify the blocks in different levels of educational development, acomposite Z-scorehas been calculated. Based onthe composite Z-score, the blocks are divided into three categories of level of educational development in terms of school availability.

Table 3: Z-score Values of the selected Variables

Block	X1	X2	X3	X4	Composite Z-score
Kaurihar	-1.35	-0.94	0.54	2.13	0.09
Holagarh	1.69	-0.88	-0.62	-0.70	-0.13
Mauaima	0.53	-0.66	0.53	-0.45	-0.01
Soraon	-0.39	-1.31	1.87	0.17	0.09
Bahria	0.40	0.10	-0.50	-0.17	-0.04
Phulpur	0.35	-1.03	-0.19	0.75	-0.03
Bahadurpur	-0.71	-1.18	0.40	1.68	0.05
Jasra	-0.65	1.65	-1.08	0.10	0.01
Shankargarh	-0.34	2.32	-1.21	-0.82	-0.01
Chaka	-2.74	-0.94	2.56	2.12	0.25
Kaudhiyara	-0.16	1.41	-1.33	-0.05	-0.03
Karchhana	1.10	-0.09	-1.08	-0.35	-0.11
Pratappur	-0.08	0.52	0.48	-0.81	0.03
Dhanupur	0.87	-0.61	1.01	-1.33	-0.02
Saidabad	0.65	-0.29	-0.37	-0.21	-0.05
Handia	0.63	0.37	-0.11	-1.04	-0.04
Meja	-0.24	-0.32	0.77	-0.05	0.04
Uruwan	-1.28	1.27	-0.55	0.81	0.06
Manda	1.05	0.22	-0.35	-1.21	-0.07
Koraon	0.69	0.39	-0.77	-0.58	-0.07

Source: Calculated by Author

Map 3

A clear spatial variation is observed in composite Z-score values representing the availability of different types of schools across blocks in Prayagraj districts (Map 3).The blocks of Holagarh, Mauaima, Bahria, Phulpur, Saidabad, Handia, Dhanupur, Karchhana, Kaudhiyara, Shankargarh, Koraon and Manda fall within the low-level category with composite Z-score values ranging from -0.130 to -0.010, suggesting very poor performance in terms of educational development. In contrast, Kaurihar, Soraon, Bahadurpur, Jasra, Meja, Uruwan, and Pratappur blocks are categorised under the medium level with composite Z-score values ranging from -0.009 to 0.090,suggesting a moderate level of educational development. Interestingly, Chaka isthe only block in the high-level category with a composite Z-score ranging from 0.091 to 0.250, suggesting a better level of education development in terms of availability of primary, secondary and higher secondary schools.

Status of Presence of Educational Amenities in the Schools of Prayagraj District

Table 4 reveals a remarkable spatial variation in the availability of basic amenities in the schools across blocks in the Prayagraj district. It is seen that, in almost all the blocks, the percentage of functional toilets for boys and girls is close to a hundred per cent. Notably, in the Bahadurpur block, all schools have functional toilets for girls. In all schools of Bahria, Karchhana, Meja, and Uruwan, functional drinking water is available, but in some blocks, such as Handia, Saidabad, Koraon, and Pratappur,its availability ranges between 70-80 per cent. A similar pattern of inter-block variation is evident in the availability of functional electricity, which is high in schools of Uruwan, Handia, Pratappur, Chaka, Bahria, Soraon, and Holagarh blocks. In contrast, Meja and Shankargarh blocks showvery low levels of electricity facilities in the schools, with relatively 34.8 per cent and 27.04 per cent, respectively. In addition, the availability of internet facilities remains very low in the schools of most of the blocks of Prayagraj district, except Soraon (86.73 per cent). It is inferred from the table that the spatial disparities in the availability of basic amenities in the schools of the Prayagraj district are remarkably high across the blocks. It suggests the need for region-specific intervention to ensure access to better education and quality educational infrastructure.

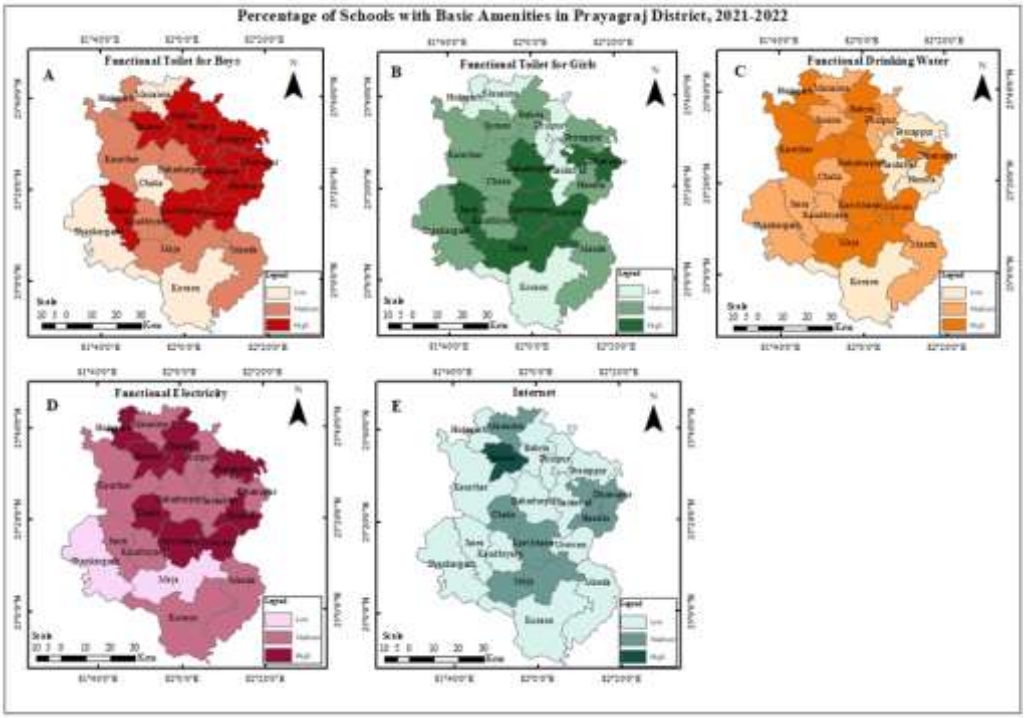
Table 4 Percentage of Schools with Basic Amenities in Prayagraj District, 2021-2022

Blocks	Toilet for Boys (X5)	Toilet for Girls (X6)	Drinking Water (X7)	Electricity (X8)	Internet (X9)
Kaurihar	97.10	97.83	99.28	57.61	6.88
Holagarh	97.40	97.40	97.92	84.90	14.06
Mauaima	95.21	96.81	95.21	61.17	20.74
Soraon	98.10	98.58	91.00	91.94	86.73
Bahria	99.23	98.46	100.00	86.15	5.00
Phulpur	98.85	97.32	95.40	71.65	7.66
Bahadurpur	96.85	100.00	99.30	70.28	12.24
Jasra	98.60	99.07	92.09	58.14	5.12
Shankargarh	95.19	98.52	94.81	27.04	8.89
Chaka	95.50	98.00	90.50	85.00	29.00
Kaudhiyara	97.74	98.31	94.92	57.06	15.25
Karchhana	98.18	99.27	100.00	77.74	19.34
Pratappur	99.26	98.88	82.90	86.62	6.69
Dhanupur	98.59	99.30	100.00	55.63	19.01
Saidabad	98.29	97.60	76.03	72.26	13.70
Handia	98.03	98.82	70.47	89.37	23.62
Meja	97.78	99.26	100.00	34.81	28.52
Uruwan	98.00	99.60	100.00	94.80	12.80
Manda	96.77	98.62	94.47	56.22	10.14
Koraon	95.14	96.42	81.59	55.24	8.44

Source: UDISE+, Department of School Education & Literacy, Ministry of Education, 2021-22

In order to present the spatial pattern of availability of basic amenities, in the schools of Prayagraj districts,several maps have been prepared (Map 4A, 4B, 4C and 4D). The functional toilet facility shows a high level of availability with minor inter-block variations. Mauaima, Chaka, Shankargarh, and Koraon blocks have comparatively low percentages (95.14-95.50 per cent), but still substantial availabilityof toilet facilities in the schools of Prayagraj district. while Soraon, Bahria, Phulpur, Pratappur, Saidabad, Dhanupur, Handia, Karchhana, Uruwan, and Jasra blocks have a high percentage (97.78-99.26 per cent), suggesting near universal access to toilet facilities for boys in the schools. The percentage of schools with functional girls' toilets in

different blocks of Prayagraj district has been shown in Map 4 (B). Holagarh, Mauaima, Phulpur, Saidabad, and Koraon blocks have a low percentage (96.42-97.60 per cent); while Bahadurpur, Dhanupur, Karchhana, Uruwan, Jasra, and Meja blocks havea high percentage (98.88-100 per cent). The spatial pattern of functional toiletfacilities reveals near universal availability of functional toilet facilities for both boys' and girls' in the schools of Prayagraj district.



Map 4

Map 4 (C) depicts the spatial pattern of schools with functional drinking water facilities across blocks of the Prayagraj district. Pratappur, Saidabad, Handia, and Koraon blocks have a low percentage (70.47- 82.90 per cent), indicating limited access to safe drinking water facilities in the schools of Prayagraj district, while blocks such as Holagarh, Kaurihar, Bahria, Bahadurpur, Dhanupur, Karchhana, Uruwan, and Meja have a high level (95.40-100.00 per cent) of availability of drinking water. Similarly, Map 4 (D) illustrates the availability of functional electricity facilities in different blocks of the Prayagraj district. The blocks like Shankargarh and Meja are categorised underthe low percentage (27.04-34.81 per cent) group, indicating a deficiency in electrification in the schools. While the blocks such asHolagrah, Soraon, Bahria, Pratappur, Chaka, Karchhana, Uruwan, and Handia blocks have a high percentage of electricity (72.26- 94.80 per cent) availability. The percentage of schools with internet facilities in different blocks of Prayagraj district has been shown in Map 4 (E). Most of the blocks, namely Holagarh, Kaurihar, Bahria, Phulpur, Pratappur, Bahadurpur, Saidabad, Uruwan, Jasra, Kaudhiyara, Shankargarh, Koraon, and Manda blocks, have a low percentage (5.00-15.25 per cent) of internet facility in the schools; while Soraon is the only block that has a high percentage of schools with internet facility (29.00-86.73 per cent).

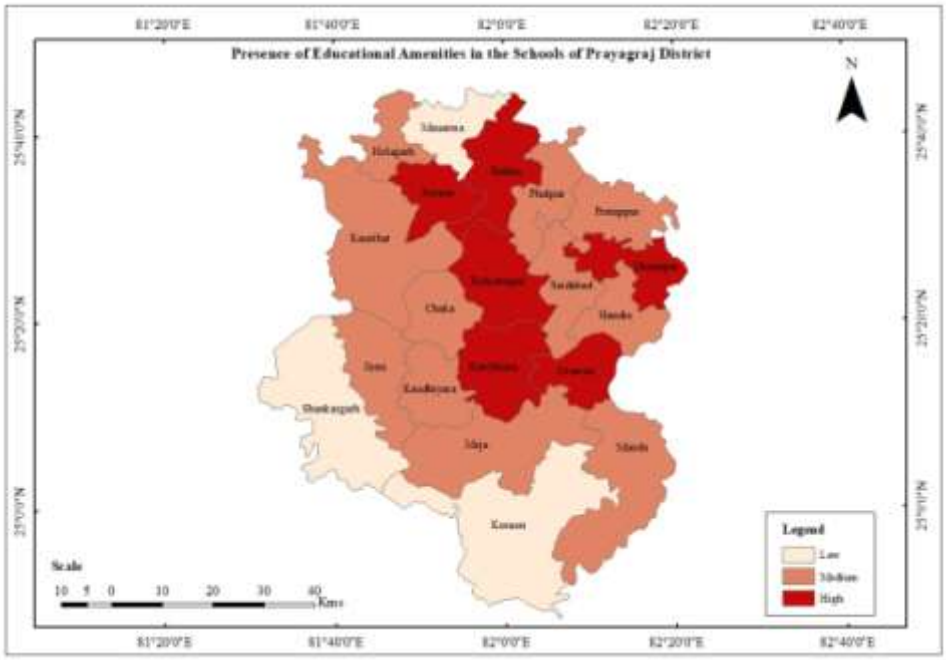
Table 5 shows composite Z-score values of basic amenities in the schools. To classify the blocks in terms of basic amenities in the schools, acomposite Z-scorehas been calculated. Based onthe composite Z-score, the blocks are divided into three categories of level of educational development in terms of educational amenities present at schools.

Table-5: Z-score Values Based on Selected Variables

Block	X5	X6	X7	X8	X9	Composite Z-score
Kaurihar	-0.30	-0.62	0.77	-0.60	-0.62	-0.28
Holagarh	-0.07	-1.09	0.61	0.88	-0.21	0.03
Mauaima	-1.76	-1.73	0.29	-0.41	0.18	-0.69
Soraon	0.47	0.19	-0.21	1.27	3.98	1.14
Bahria	1.34	0.06	0.86	0.95	-0.73	0.50

Phulpur	1.05	-1.17	0.31	0.16	-0.58	-0.05
Bahadurpur	-0.49	1.73	0.78	0.09	-0.31	0.36
Jasra	0.85	0.72	-0.08	-0.57	-0.72	0.04
Shankargarh	-1.77	0.13	0.24	-2.27	-0.51	-0.84
Chaka	-1.53	-0.44	-0.27	0.89	0.65	-0.14
Kaudhiyara	0.19	-0.10	0.25	-0.63	-0.14	-0.09
Karchhana	0.53	0.94	0.86	0.49	0.09	0.58
Pratappur	1.36	0.52	-1.18	0.98	-0.63	0.21
Dhanupur	0.85	0.97	0.86	-0.71	0.08	0.41
Saidabad	0.62	-0.87	-2.00	0.20	-0.23	-0.46
Handia	0.42	0.45	-2.66	1.13	0.34	-0.07
Meja	0.22	0.93	0.86	-1.85	0.62	0.16
Uruwan	0.39	1.30	0.86	1.42	-0.28	0.74
Manda	-0.56	0.23	0.20	-0.68	-0.44	-0.25
Koraon	-1.81	-2.15	-1.34	-0.73	-0.53	-1.31

Source: Calculated by Author



Map 5

Map 5 shows the spatial distribution of composite Z-score values representing the availability of basic amenities in the schools of Prayagraj district. The blocks ofMauaima, Shankargarh and Koraon are in the low-level category with composite Z-score values ranging from -1.310 to 0.690, indicating the poor level of educational infrastructure development. However, Holagarh, Kaurihar, Chaka, Jasra, Kaudhiyara, Meja, Manda, Phulpur, Pratappur, Saidabad and Handia blocks are categorised under the medium level category with Z-score values ranging between -0.689 to 0.210. The blocks of Bahria, Soraon, Bahadurpur, Dhanupur, Karchhana, and Uruwan are in the high-level category with composite Z-score values of 0.210 to 1.140. These blocks have better provision of availability of basic amenities, showing better educational infrastructural development.

VI. Conclusion

From the above discussion, it may be concluded that the gender disparity and caste disparity in literacy rate is available in the blocks of Prayagraj district.Spatial inequality in terms of presence of schools in the blocks is clearly visible. Blocks close to the urban centre, such as Chaka, Kaurihar, Bhadurpur, Soraon, Jasra has better

position compare to peripheral rural blocks, such as Holagarh, Mauaima, Bahria, Manda, Koraon etc.In terms of availability of educational amenitiesthese inequalities are more prominent, southern blocks of the district such as, Koraon and Shankargarh lack these amenities while blocks located in middle of the district such as Karchhana, Soraon, Bahria, Uruwan has better availability.Overall, the Koraon block has a low level of development in both aspects,i.e., the presence of schools and educational amenities. Therefore,to achieve balanced regional development, and to fulfil sustainable goals, i.e. quality education (SDG 4), clean water and sanitation (SDG 6), and reduced inequalities (SDG 10),the government should focus on reducingtheseinequalities available in educational infrastructure. This will improve not only educational performance, but also overall socioeconomic development and regional equity.

References

[1]. Agrawal, T. (2014). Educational inequality in rural and urban India. International Journal of Educational Development, 34, 11–19. https://doi.org/10.1016/j.ijedudev.2013.05.002
[2]. ASER Centre. (2022). Annual Status of Education Report (Rural) 2022. New Delhi.
[3]. Ashraf, S., & Siddiqui, M. A. (2013). Spatial disparities in social infrastructure in western Uttar Pradesh. Indian Journal of Regional Science, 45(2), 87–96.
[4]. Barro, R. J., & Lee, J. W. (2013). A new data set of educational attainment in the world, 1950–2010. Journal of Development Economics, 104, 184-198.
[5]. Becker, G. S. (1993). Human capital: A theoretical and empirical analysis, with special reference to education. The University of Chicago Press.
[6]. Behl, A., & Singh, R. (2019). Block-Level Analysis of Regional Disparities in Educational Development in Punjab. 7(6).
[7]. Bhagwati, L., & Sarma, D. (2024). Relative educational status of Assam: A district-level study. Educational Administration: Theory and Practice, 30(5), 11063-11072.
[8]. Chetty, R., Hendren, N., Kline, P., & Saez, E. (2014). Where is the land of opportunity? The geography of intergenerational mobility in the United States. Quarterly Journal of Economics, 129(4), 1553–1623.
[9]. Drèze, J., & Sen, A. (2013). An uncertain glory: India and its contradictions. Princeton University Press.
[10]. Earthman, G. I. (2002). School facility conditions and student academic achievement. UCLA's Institute for Democracy.
[11]. Fatima, N., Singh, J., Fatima, T., Akram, T., & Hashmi, S. N. I. (2024). Levels of educational and health development in Aligarh district of Uttar Pradesh, India.
[12]. Fotheringham, A. S., Brunsdon, C., & Charlton, M. (2000). Quantitative geography: Perspectives on spatial data analysis. Sage.
[13]. Government of Uttar Pradesh. (2022). Basic Education Statistics.
[14]. Government of Uttar Pradesh. (2022). Statistical diary of Uttar Pradesh. Directorate of Economics and Statistics.
[15]. Sharma, G., & Patil, G. R. (2022). Spatial and social inequities for educational services accessibility: A case study for schools in Greater Mumbai. Cities, 122, 103543, https://doi.org/10.1016/j.cities.2021.103543
[16]. Hanushek, E. A., &Woessmann, L. (2012). Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. Journal of Economic Growth, 17(4), 267–321.
[17]. Hoque, J., & Hashmi, P. S. (2020). Regional disparity in the levels of educational development in Uttar Dinajpur. IJSRD International Journal of Scientific Research & Development, 8, 77-81.
[18]. Hota, S. P. (2023). Education infrastructure, expenditure, enrollment & economic development in Odisha, India. International Journal of Educational Development, 103, 102903.
[19]. Jhingran, D. (2009). Access and equity in elementary education in India: Country analytical review. NUEPA.
[20]. Kingdon, G. G. (2020). The private schooling phenomenon in India. Oxford Review of Education, 46(5), 1–19.
[21]. Kumar, A., & Sinha, R. (2011). Regional disparities in educational development in Uttar Pradesh. Journal of Regional Development and Planning, 1(1), 35–46.
[22]. Kumari, R. (2020). Educational attainment in India: Trends and patterns. Social Change, 50(1), 1–15.
[23]. Ministry of Education. (2022). UDISE+ Report 2021–22. Government of India.
[24]. Mishra, A. (2023). Spatial Inequality and Education: Unravelling the Geographical dimensions of Educational disparities. Technolearn An International Journal of Educational Technology, 13(1). https://doi.org/10.30954/2231-4105.01.2023.6
[25]. Misra, K. N. (2024). Educational Infrastructure and Its Impact on Regional Development in Eastern Uttar Pradesh. 25.
[26]. Morton, A. D. (2007). Spaces of Global Capitalism: Towards a Theory of Uneven Geographical Development. Contemporary Political Theory, 6(3), 381–382. https://doi.org/10.1057/palgrave.cpt.9300296
[27]. Naik, M. G., & Sharada, V. (2013). Educational development in Karnataka: Inter-district disparities. International Journal of Advanced Research in Management and Social Sciences, 2(10), 26-33.
[28]. Swarnkar, S., & Gaurav, S. K. (2019). Spatial Pattern of Educational Development at Block Level in Jalore District, Rajasthan. Journal of Global Resources, 06(01), 160–164. https://doi.org/10.46587/JGR.2019.v06i01.025
[29]. Sen, A. (1999). Development as freedom. Oxford University Press.
[30]. Singh, A. (2015). Private school effects in urban and rural India: Panel estimates at primary and secondary school ages. Journal of Development Economics, 113, 16–32.
[31]. Soja, E. W. (2010). Seeking spatial justice. University of Minnesota Press.
[32]. Tilak, J. B. G. (2018). Education and Development in India: Critical Issues in Public Policy and Development. Springer Singapore. https://doi.org/10.1007/978-981-13-0250-3
[33]. Tikly, L. (2011). Towards a framework for research on education and development. International Journal of Educational Development, 31(1), 1–8.
[34]. Tilak, J. B. G. (2002). Education and poverty. Journal of Human Development, 3(2), 191–207.
[35]. Tiwari, R. (2021). School infrastructure and enrolment in elementary education in Uttar Pradesh: A Tobit analysis. Educational Planning, 28(2), 45–60.
[36]. UNDP. (2016). Human Development Report 2016. United Nations.
[37]. World Bank. (2009). World development report 2009: Reshaping economic geography. World Bank.
[38]. World Bank. (2018). World Development Report: Learning to Realise Education's Promise.