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Status and development of educational infrastructure in rural primary schools of West Bengal

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Abstract

Geographic disparities and imbalanced development significantly impact the inclusive growth of education. The accessibility of school infrastructure is a key factor in the enhancement of the quality of education. This study aims to explore the changing trends, patterns and level of development of Primary School infrastructure facilities from 2012 to 2021 in Rural West Bengal. The infrastructure facilities data of rural primary schools (I-V) were collected from the Unified District Information System for Education (UDISE) plus report for the years 2011-12 and 2021-2022. A composite index has been used to quantify the level of school infrastructure development. The concentration level of various facilities was measured using the Location Quotient method in this study. This study reveals that the northern part of West Bengal has a low level of school infrastructure. In contrast, the southern part of West Bengal belongs to a high level of school infrastructure, except for South 24 Parganas. Almost all districts have drinking water facilities, as well as separate restrooms for boys and girls. However, all rural primary schools have low levels of newspaper, hand washing, water purifiers, medical check-ups, and computer facilities. The government should provide more funding to build new schools and educational facilities. This study will assist policymakers and other stakeholders in formulating policies and developing educational infrastructure.

Keywords: Regional disparity, primary school infrastructure, academic performance, composite index, West Bengal

1. Introduction

Educational attainment is considered to be one of the most important factors of economic growth and social development in developing nations. An effective elementary school-driven educational framework is necessary for any country to grow. Everyone knows how essential primary education is. The backbone for learning and growth across all stages is primary education (Dutt and Kundu, 2018) ^[6]. Education plays a vital role in rural development. In most developing nations, the 1990s saw a significant neglect of the rural dimension of the fundamental educational problem (Atchoarena & Gasperin, 2003) ^[2]. The comprehensive educational growth of an area depends on its educational infrastructure. The availability of teachers, classrooms, libraries, laboratories, hostels, playgrounds, electricity, drinking water, bathrooms, computers, and other amenities all have a significant impact on educational quality. The imbalance in accessibility of educational facilities contributes to a more significant gap in the standard of education. Proper educational infrastructure is necessary for the child's overall development (Mahapatra, 2019) ^[13]. The Right to Education Act (RTE) of 2009 states that every school must have an all-weather building, enough staff, a minimum of one classroom per teacher, separate restrooms for boys and girls, a safe and sufficient supply of water to drink, a playing area, a kitchen for midday meals, and arrangements for maintaining the school premises safe by boundary. Students can learn better in a suitable environment with modern facilities, which are essential for enhancing their performance and learning (Shami, 2005) ^[20]. In recent times, some studies have focused on finding out the relationship between Primary school infrastructure and the academic performance of the student. Karmakar (2016) ^[11] examines the connection between enrolment and school infrastructure in West Bengal. They found a strong link between enrolment interschool infrastructure, midday meals, drinking water, and the appearance of a teacher. Jamil *et al.* (2018) ^[9] tried to determine the influence of school infrastructure on students' academic achievement in Khyber Pakhtunkhwa. They

discovered that resources such as gas, electricity, libraries, and high-quality instruction service improve student achievement. Janu (2020) ^[10] in his study used composite index method to analyse the level of infrastructural development in Rajasthan. Majhi and Mallick (2019) ^[14] applied a multiple linear regression method to determine the influence of school infrastructure facilities on gross enrolment in primary schools in Odisha using District Information System for Education (DISE) data. They discovered that physical infrastructure has an important impact on enrolment in primary schools.

The Indian government considers universal access to education as one of its top priorities. The Pratham Annual Status of Education Report in 2014 indicates that 96.7% of children in India's rural areas (ages 6 to 14) are enrolled in school. But attendance varies around the state. West Bengal, Uttar Pradesh, and Bihar have recorded the lowest rates of attendance. India has over 1.5 million primary schools (Mandal and Sarkar, 2020) ^[15]. The majority of schools are located in rural areas and do not meet average quality standards, such as shelter-less educational institutions, insufficient facilities, a high pupil-teacher ratio, traditional way teaching techniques, and a high absence rate (Bhunia and Shit, 2012) ^[4].

According to the Census 2011, West Bengal's literacy rate is 77.1%. It's excellent compared to the national rate of 74%. Over the last twenty to thirty years, both the gross and net enrolment rates in West Bengal have risen significantly. The quality of education has improved over the previous ten years. But, many primary schools in West Bengal don't have

basic facilities like classrooms, bathrooms, drinkable water, or playgrounds. It not only makes it challenging to provide a quality education, but it also affects students' achievement and development overall. An attempt has been made in this paper to explore the changing trends and patterns of Primary School infrastructure facilities (in percentage) from 2012 to 2021 in Rural West Bengal and analyse the level of primary school infrastructure development and its relation with the academic performance of the student. This study will help policymakers and other stakeholders formulate policies and develop educational infrastructure.

2. Materials and Methods

2.1 Study Area

West Bengal is the only state in India that the Himalayas surrounds to the north and the Bay of Bengal to the south. The remaining territory is comprised of both plains and plateaus. It is located between 85° 50' and 89°50' east longitude and between 21°38' North and 27°10' north latitude. Within the Nadia district, the tropic of Cancer travels through its southernmost point. West Bengal is India's fourth largest-population state, as per the 2011 Census data. According to the 2011 census, West Bengal's urban population was 29093002, accounting for around 31.81% of the total population. The entire rural population is 62183113, accounting for approximately 68.13% of the total population. The overall literacy rate of West Bengalis is 77.08%. Among the entire population, 82.67% of males are literate, whereas only 71.16% of females are literate.

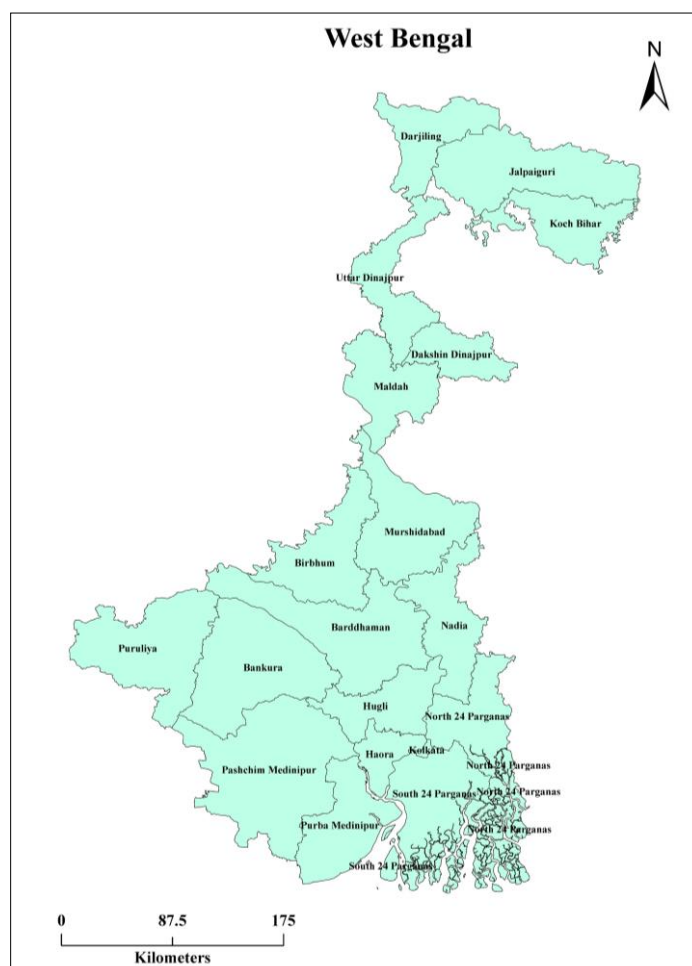


Fig 1: Location map of the study area

2.2 Data

Data on the infrastructure of rural primary schools (I-V) were gathered from the Unified District Information System for Education (UDISE) plus report for the years 2011-12 and 2021-2022. This data gives detailed information on primary school infrastructure. Student academic performance data has been collected from National achievement Survey (NAS) 2021. This study exclusively included primary schools under the jurisdiction of the Department of Education, Government of West Bengal.

2.3 Selection of Indicator

Based on data base availability, we selected a few key indicators that are relevant to education in order to better understand the infrastructural features of rural primary schools: 1. Electricity availability; 2. Playground facility; 3. Library or Reading Corner or Book Bank facility; 4. Newspaper facility; 5. Furniture facility; 6. Having separate Boy's Toilet; 7. Having separate Girl's Toilet; 8. Having Functional Drinking Water; 9. Hand wash facility; 10. Medical Check-up facility; and 11. Computer Available, 12. Availability of water purifier, 13. Availability of internet connection, 14. Availability of rain water harvesting facility.

2.4 Method

2.4.1 Normalisation of data by Min-Max Method

The normalisation procedure plays a crucial role in the field of data mining. It standardises the data to a uniform scale. The Min-max approach is a significant technique in the normalisation strategy. This method is utilised to rescale the data, transforming it to a range between 0 and 1. In this context, the minimum value of a specific attribute will be mapped to 0, the maximum value of the same attribute will be mapped to 1, and all other values will be transformed into a decimal between 0 and 1. We have discovered a mathematical formula for the Min-Max method in the OECD handbook for creating the Composite index. If the variable has a positive correlation with development, the formula is

$$\frac{(Vi - MinA)}{(MaxA - MinA)} * (New MaxA - New MinA) + New MinA$$

When the variable has a negative relationship with the development, the formula.

$$\frac{MaxA - Vi}{MaxA - MinA} * (New MaxA - New MinA) + New MinA$$

Where Vi =value of A variable of i place
 $MaxA$ = Maximum variable of A variable,
 $MinA$ = Minimum variable of A variable
 $New MaxA=1$, $New MinA =0$

2.4.2 Constructing Composite Index

It shows a single value that represents the sum of the values of the several variables. As a result, we can conclude that it is a comprehensive, multidimensional index. It is a simple sum of all indicators. We have utilised it to track progress. The composite index has values ranging from 0 to 1. In this study, we used multiple parameters to create a composite index that shows the level of development.

2.4.3 Location Quotient Method

The 'Location Quotient' is a simple ratio used to determine

the dominance of a particular phenomenon in a region compared to a larger region or benchmark region. It is used to compare a phenomenon of a local region with a component of a national region. It helps to identify the disparity of a phenomenon in a small region.

$$L. Q = \left(\frac{Xi}{Ni}\right) / \left(\frac{X}{N}\right)$$

Where, $L. Q$ = Location Quotient

Xi =the amount of some X in region i

Ni = Total amount of X in region i

X = The amount of X in a larger region (nation, state, etc.)

N = Total amount of X in larger region (nation, state)

3. Result

3.1 Result of Changing trends and patterns of Primary School (I-V) infrastructural facilities in rural West Bengal

Table 1 displays the infrastructure of primary schools (I-V) in rural West Bengal between 2012-2013 and 2021-2022, including the following: electricity, playground, library or reading corner or book bank, newspaper, furniture, boy's and girl's toilets, functional drinking water, hand wash facility, medical check-up, and computer availability.

Electricity facilities: As of 2021-2022, all rural Nadia and Purba Medinipur primary schools have electricity, while 89.59% of Maldah's and 71.29 % of Darjeeling's primary schools have electricity. In every other district, between 96% and 99% of the elementary schools were electrified. In every district, the availability of electrical utilities increased between 2011-2012 and 2021-2022. Hooghly (44.59%) has seen the most minor improvement, while Jalpaiguri (87.32%) has seen the most. The districts of Puruliya (86.72%), Uttar Dinajpur (84.36%), Coochbehar (84.31%), Purba Medinipur (77.71%), Murshidabad (74.79%), Nadia (73.37%), Birbhum (72.13%), Paschim Medinipur (72.00%), and Bankura (70.64%) have all seen an increase in electricity of more than 70%.

Playground facility: As of 2021-2022, Puruliya (43.32%) had the lowest percentage of primary schools with playground facilities, while Cooch Behar (100%) had the highest percentage. Bankura, Purba Medinipur, and Birbhum districts have more than 60% of the elementary schools with playgrounds. Conversely, less than 60% of playgrounds are present in any other district. From 2012-2013 to 2021-2022, Birbhum saw the most increase in its number (46.78%). In rural primary schools located in the districts of Bankura, Bardhaman, Murshidabad, and Hooghly, it rises from 30% to 44%.

Library or Reading Corner or Book Bank: As of 2021-2022, 99.92% of primary schools in Cooch Behar and 12.09 % of schools in Darjeeling, respectively, had a library, reading nook, or book bank. More than 90% of primary schools in every district aside from Dakshin Dinajpur and South 24 Pargana have libraries. In the districts of Purba Medinipur (91.18%), Paschim Medinipur (89.41%), Howrah (88.07%), and Hooghly (84.19%), more than 80% of rural primary schools expand library facilities.

Newspaper facilities: In terms of primary school newspaper facilities as of 2021-2022, Uttar Dinajpur (8.94%) had the highest percentage and Darjeeling (0.5%) had the lowest. The percentage of primary schools in all rural areas with newspaper facilities is lower.

Furniture facilities: As of 2021-2022, the largest percentage of primary schools with furniture facilities is found in Bankura (97.26%), followed by Purba Medindipur (94.61%) and Uttar Dinajpur (79.45%). In the rural districts of Howrah, Jalpaiguri, Hooghly, North 24 Pargana, Puruliya, and South 24 Pargana, this facility is accessible in over 90% of cases. Over 60% of the schools in the districts of Bankura (75.10%), South 24 Pargana (69.82%), Howrah (69.17%), Purba Medindipur (68.12%), and had improvements in amenities between 2012-2013 and 2021-2022.

Boy's toilet and Girl's toilet facilities: As of 2021-2022, every rural West Bengal district had a boy's toilet, with the exception of North 24 Pargana (99.94%). On the other hand,

every primary school in every rural area has a girls' toilet. Boy's toilet facilities in the districts of Coochbehar (80.97%), Maldah (78.54%), Puruliya (74.66%), Birbhum (72.36%), and Jalpaiguri (70.46%) increased by more than 70% between 2012-2013 and 2021-2022.

Functional drinking water: Every rural primary school in every district of West Bengal except Darjeeling (79.40%) will have a fully functional drinking water system by 2021-2022. Between 2012-2013 and 2021-2022, the facility experienced improvements; North 24 Pargana had the lowest percentage (1.81%), and Darjeeling had the highest percentage (65.46%). In every other district, the facility's increase has been less than 22%.

Table 1: Changing trends and patterns of Primary School infrastructure facilities (in percentage), Rural West Bengal, 2012-2013 and 2021-2022

District-wise primary school infrastructure facilities	Electricity		Playground		Library or Reading Corner or Book Bank		Newspaper		Furniture		Boy's Toilet		Girl's Toilet		Toilet Facility		Functional Drinking Water		Handwash		Medical Check up		Computer Available		Total no of primary school (I-V)	
	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013	2021-2022	2012-2013
Bankura	99.97	29.33	71.29	27.49	97.47	88.27	3.76	0.98	97.25	22.16	100.00	58.73	100	85.08	100	86.99	100.00	87.28	99.53	9.83	94.75	20.70	3.47	0.45	3831	3358
Bardhaman	99.86	37.73	59.95	36.66	99.70	92.74	5.47	6.04	84.15	61.81	100.00	72.50	100	85.59	100	87.55	100.00	92.16	99.38	26.01	93.70	60.65	4.01	2.08	4335	3276
Birbhum	98.61	26.48	66.18	19.40	98.54	72.54	8.76	0.93	82.27	75.57	100.00	27.64	100	67.73	100	70.18	100.00	87.81	99.06	47.04	79.87	36.76	4.52	0.89	2877	2247
Cooch Behar	98.98	14.67	100.00	75.79	99.92	72.24	2.73	0.99	89.69	45.87	100.00	19.03	100	43.83	100	46.33	100.00	87.49	99.10	60.42	80.36	28.46	0.41	0.99	2454	1718
Dakshin dinajpur	99.94	32.82	52.88	51.96	86.82	76.03	1.52	0.46	87.00	33.64	100.00	42.30	100	99.73	100	99.73	100.00	90.98	97.27	57.16	66.97	56.79	1.21	0.64	1647	1097
Darjeeling	71.93	8.81	67.47	69.16	12.79	0.59	0.52	0.88	89.44	26.14	100.00	32.16	100	60.06	100	62.41	79.40	14.54	86.61	13.95	63.00	12.63	4.12	3.38	1165	681
Hooghly	99.89	55.30	55.55	22.39	99.33	15.14	1.56	0.79	92.01	43.36	100.00	52.74	100	96.89	100	97.64	100.00	87.39	99.47	15.21	96.67	33.54	9.33	6.35	2819	2537
Howrah	99.95	48.95	50.69	25.19	98.20	10.12	2.92	0.56	93.73	24.57	100.00	57.35	100	89.38	100	90.68	100.00	84.07	98.73	10.06	96.34	61.48	5.94	1.85	1884	1620
Jalpaiguri	95.92	12.49	72.53	77.10	84.97	20.48	0.81	2.57	84.19	35.28	100.00	29.54	100	96.25	100	99.46	100.00	90.19	95.52	12.92	75.03	57.21	2.56	0.86	2967	1865
Maldah	89.29	20.80	52.49	36.33	91.09	85.02	2.37	0.61	85.85	30.12	100.00	21.46	100	74.88	100	76.10	100.00	77.87	97.59	27.29	64.68	36.33	7.81	1.11	2446	1803
Murshidabad	97.03	22.24	58.22	23.61	99.91	100.00	5.16	0.79	79.90	64.80	100.00	30.11	100	56.11	100	60.18	100.00	90.52	99.89	35.37	76.94	61.20	2.28	0.55	4380	2923
Nadia	100.00	26.63	44.31	26.63	98.93	32.15	1.92	0.35	84.60	50.26	100.00	34.97	100	79.67	100	81.36	100.00	93.18	98.51	19.33	82.47	50.39	3.81	1.56	2812	2302
North twenty four pargana	98.87	35.48	57.36	46.23	99.57	42.39	3.59	0.63	91.94	38.39	99.94	73.62	100	93.81	100	95.45	100.00	98.19	99.15	30.21	92.00	20.14	4.65	1.31	3288	2373
Paschim medinipur	99.59	27.39	79.23	43.38	95.76	9.86	2.89	0.39	89.60	34.76	100.00	44.30	100	94.49	100	94.72	100.00	86.51	99.67	51.20	89.23	43.63	0.97	0.64	6881	4359
Purba medinipur	100.00	22.29	66.87	50.29	97.88	6.71	2.14	0.68	94.91	26.80	100.00	32.34	100	99.06	100	99.77	100.00	84.02	99.04	16.92	88.37	59.33	1.05	2.04	4488	3086
Puruliya	98.91	12.19	43.32	17.26	98.21	30.76	2.27	0.71	91.55	65.73	100.00	25.34	100	85.93	100	86.64	100.00	82.00	97.12	6.77	62.67	25.83	1.76	1.13	3303	2822
South twenty four pargana	97.88	30.12	53.94	50.66	79.48	63.65	3.40	2.80	90.93	21.12	100.00	60.85	100	81.18	100	88.09	100.00	84.62	97.21	13.43	89.02	36.09	3.13	1.19	4800	3433
Uttar dinajpur	96.68	12.33	54.55	53.63	58.09	51.65	8.94	1.10	79.44	56.42	100.00	49.67	100	77.55	100	80.48	100.00	84.52	94.72	10.34	53.06	28.03	12.38	0.51	2350	1363
Average	96.85	26.45	61.49	41.84	88.70	48.35	3.37	1.24	88.25	42.04	100.00	42.48	100.00	81.51	100.00	83.54	98.86	83.52	97.64	25.75	80.29	40.51	4.08	1.53	58727	42863

Source: Table computed by authors; data collected from UDISE plus report

Handwashing facilities: Murshidabad (99.89%) had the highest rate of primary schools having handwashing facilities as of 2021-2022, while Darjeeling (86.61%) had the lowest rate. Every district has experienced improvements in this service of more than 50%, with the exception of Paschim Medinipur (47.65%), Dakshin Dinajpur (40.11%), and Coochbehar (38.68%).

Medical check-up facility: As of 2021-2022, Uttar Dinajpur (53.16%) had the lowest percentage of primary schools with a medical check-up facility, while Hooghly (96.67%) had the highest rate. Approximately 80% of primary schools in the districts of Jalpaiguri, Howrah, Bankura, Bardhaman, North 24 Pargana, South 24 Pargana, Purba Medinipur, Paschim Medinipur, Nadia, and Cooch Behar have this facility. Over

half of the primary schools in the districts of Bankura (74.06%), North 24 Pargana (71.86%), Hooghly (63.12%), Darjiling (63.35%), South 24 Pargana (89.93%), and Coochbehar (51.90%) improved their medical check-up facilities between 2012-2013 and 2021-2022.

Computer availability: Based on data from 2021-2022, Cooch Bihar (0.41%) has the lowest percentage of pupils in primary schools with computers, while Uttar Dinajpur (12.38%) has the highest percentage. Most rural schools in West Bengal do not have access to computers

School Infrastructure Development in Rural West Bengal (2021)

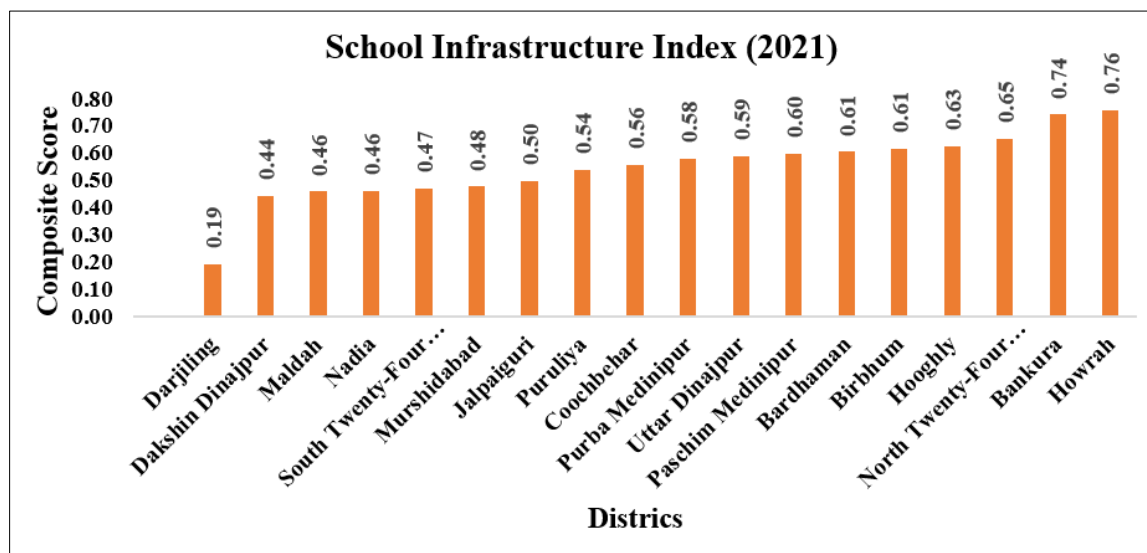


Fig 2: District wise Spatial pattern of school infrastructure development in rural West Bengal

Fig. 2 represents the spatial pattern of the level of development of school infrastructure in rural West Bengal. The standard of school infrastructure was evaluated based on the composite score which was the combination of 12 selected indicators. In 2021, it was recorded that Howrah (0.76) ranked highest in the case of School Infrastructure Index (SII), followed by Bankura (0.74), North Twenty-Four Pargana (0.65), Hooghly (0.63) Bardhaman (0.61), Birbhum (0.61) Paschim Medinipur (0.60), South Twenty-Four Pargana (0.59), Purba Medinipur (0.58). Low SII value has been found in Darjiling (0.19), Dakshin Dinajpur (0.44), Maldah (0.46), Nadia (0.46), South Twenty-Four Pargana (0.47) Murshidabad (0.48), Jalpaiguri (0.50), Puruliya (0.54) and Coochbehar (0.56) South Twenty-Four Pargana (0.47). This study reveals that the northern part of West Bengal has a low level of school infrastructure. In contrast, the southern part of West Bengal belongs to a high level of school, except for South 24 Parganas, where physical barriers play an important role in the development of infrastructure facilities. Most of the parts of this district are coastal hazard-prone areas. On the other hand, in North Bengal, environmental barriers may be the cause of the low level of infrastructure development. Most of the part of this region is connected with hilly areas and mountain areas. On the other side, most of the parts of South Bengal are attached to plain areas. Development of infrastructure facilities, such as electric connection, water connection and availability of playground facility, etc, is highly suitable for plain areas rather than hilly areas. Here, accessibility to education and health infrastructure service is easy. Due to industrialization and highly fertile land, this region is economically more strong than North Bengal.

3.2 Level of concentration of availability of various dimensions of primary school infrastructure in rural West Bengal

Table 2 represents the concentration of availability of various school infrastructure in primary schools in rural West Bengal. Here, > 1 value indicates high concentration, < 1 value

indicates low concentration, close to 0 shows nearly concentration, and 0 indicates perfect balance concentration. In this study, to determine the level of concentration of number of schools having different infrastructure facilities to school, we have selected 12 dimensions: playground, reading corner, Newspaper facility, furniture, medical check-up, computer availability, solar panel, kitchen garden, Water Purifier, rainwater harvesting facility, Incinerator facility and Internet facility. $L.Q > 1$ value indicates that there is a higher concentration of value than the national or regional average. This region is unique from the central area.

From the study, the concentration level of various school infrastructure availability is unequal in the whole region. In case of availability of playground, the level of concentration is very high in Cooch Behar (1.60), Paschim Medinipur (1.27), Jalpaiguri (1.27) and Bankura (1.14). And level of concentration is low in Puruliya (0.69), Nadia (0.71), Howrah (0.81), Dakshin Dinajpur (0.89). In case of availability of reading corner, most of the district belonging from the nearly balanced concentration level except Darjeeling (0.14), Uttar Dinajpur (0.63), South Twenty-Four Pargana (0.86). All of this region belongs to the backward region.

Nearly balanced concentration has been found in almost all of the districts in terms of furniture availability. In terms of the availability of computers, solar panels, Water purifiers, rainwater harvesting facilities and Incinerator facilities, most of the districts found low concentration levels. Overall, good conditions in terms of concentration levels in various facilities have been found in Howrah, Hooghly, Bankura, Bardhaman, and Paschim Medinipur. Poor conditions have been found in Darjeeling, Puruliya, Jalpaiguri, Dakshin Dinajpur Murshidabad and South Twenty-Four Pargana. Here, Darjeeling belong from the hilly area. Other remaining, all districts belong to the backwardness in terms of geographical or socio-economic status. The government needs to give more attention to the development of school infrastructure in these districts. This attempt can influence the overall development of student performance, improving enrolment and reducing the dropout rate.

Table 2: Patterns of concentration level of Primary School infrastructure facilities (in percentage), Rural West Bengal (2021-2022)

District	No of school having playground to the total school	No of school having reading corner to total school	No of school having newspaper facility to total school	No of school having Furniture to total school	No of school having medical check-up facility to total school	No of school having computer availability to total school	No of school having solar panel to total school	No of school having kitchen garden to total school	No of school having Water Purifier to total school	No of school having rain water harvesting facility to total school	No of school having Incinerator facility to total school	No of school having Internet facility to total school
Bankura	1.14	1.06	1.08	1.10	1.15	0.96	0.54	1.02	0.82	0.81	0.62	0.81
Bardhaman	0.96	1.08	1.56	0.95	1.13	1.11	0.34	1.41	0.93	1.57	1.44	0.32
Birbhum	1.06	1.07	2.51	0.93	0.97	1.25	0.57	0.72	0.71	1.07	1.74	1.09
Cooch behar	1.60	1.08	0.78	1.01	0.97	0.11	1.85	0.91	0.59	0.58	1.68	0.44
Dakshin Dinajpur	0.85	0.94	0.43	0.98	0.81	0.33	0.82	1.38	0.60	0.89	1.04	1.13
Darjiling	1.08	0.14	0.15	1.01	0.76	1.14	0.41	0.50	0.57	1.00	0.58	0.12
Hooghly	0.89	1.08	0.45	1.04	1.17	2.57	0.46	1.08	0.85	3.34	0.89	0.44
Howrah	0.81	1.06	0.84	1.06	1.17	1.64	0.66	1.07	1.32	1.29	0.89	1.86
Jalpaiguri	1.16	0.92	0.23	0.95	0.91	0.71	1.05	0.92	0.77	0.66	0.72	0.36
Malda	0.84	0.99	0.68	0.97	0.78	2.15	0.72	0.70	0.53	0.99	0.80	1.17
Murshidabad	0.93	1.08	1.48	0.90	0.93	0.63	0.54	1.21	0.57	0.83	0.89	0.65
Nadia	0.71	1.07	0.55	0.96	1.00	1.05	0.76	0.79	0.58	0.73	1.17	0.59
North Twenty-Four Pargana	0.92	1.08	1.03	1.04	1.11	1.28	0.59	0.82	1.01	0.72	1.16	0.99
Paschim Medinipur	1.27	1.04	0.83	1.01	1.08	0.27	0.93	1.23	2.69	0.92	0.78	2.67
Purba Medinipur	1.07	1.06	0.61	1.07	1.07	0.29	0.54	0.85	0.84	0.84	0.77	0.53
Puruliya	0.69	1.06	0.65	1.03	0.76	0.48	2.72	0.83	0.88	0.71	0.85	1.78
South Twenty-Four Pargana	0.86	0.86	0.97	1.03	1.08	0.86	2.83	1.07	0.47	0.73	0.94	0.33
Uttar Dinajpur	0.87	0.63	2.56	0.90	0.64	3.41	0.80	0.71	1.29	0.60	1.36	1.43

Source: Table computed by authors; data collected from UDISE plus report

4. Discussion

This study found substantial improvement in basic school infrastructures in rural West Bengal from 2012-13 to 2021-22. Most of the district has shown improvement because of government intervention in some important basic facilities such as electricity, drinking water and sanitation after performing the RTE act and educational policies. The result supports the other previous studies which emphasize the role of government in increasing the basic educational infrastructure in rural India (Govinda & Bandyopadhyay, 2010) [23].

Overall progress was noted in terms of infrastructural development, but the study also observed excessive spatial disparities among the districts. In the case of infrastructure development of primary school, Howrah, Bankura and North 24 Parganas in the southern part of West Bengal is more developed compared to northern and geographically backward districts. Topographical characteristics, economic progress, and accessibility may be the main reasons for these kinds of disparities. The hilly topography of North Bengal

and the threat of coastal hazards in some districts is a challenge for infrastructure development expansion (Chatterjee, 2015; Mukherjee & Das, 2018) [24, 25]. At the other level, almost all districts experienced the near universal coverage of certain most basic amenities but access to recent good and relatively better-quality service like computers, internet or more appropriate existing Learning environments remain restricted in many rural west Bengal. LQ analysis also indicates strong inequity in the distribution of infrastructural facilities. While several districts Howrah, Hooghly and Paschim Medinipur are relatively better placed in terms of primary school infrastructure, others such as Darjeeling, Puruliya and Jalpaiguri experience lower levels of concentration indicating the absence of basic services/infrastructure. Such trends highlight the need for a region-specific planning approach. The need to reduce the regional gap and improve access to digital learning or higher-quality materials is pressing. Infrastructural development in low-income and socio-economically disadvantaged areas needs further specific intervention region-wise.

5. Conclusion

Educational infrastructure is very important for improving overall development in education. The spatial inequality in the accessibility of educational infrastructure impacts the quality of education. The present study attempts to explore the changing trends and patterns of Primary School infrastructure facilities (in percentage) from 2012 to 2021 in Rural West Bengal and analyse the level of primary school infrastructure development and its relation with the academic performance of the student.

This study found that the northern part of West Bengal has a low level of school infrastructure. In contrast, the southern part of West Bengal belongs to a high level of school infrastructure, except for South 24 Parganas. Environmental obstacles in North Bengal may be responsible for the low level of infrastructural development. The majority of this region is connected by hills and mountains. On the other hand, the majority of South Bengal is connected to plain areas. Some educational facilities in this state are inadequate. Concentration level of availability of playground, solar panel, water purifier, computer, internet connection and medical check-up facility of primary school in rural West Bengal is not uniform. There is a huge disparity. Water purifier, computer, internet connection and medical check-up should be improved in the schools of West Bengal. The results demand an extensive evaluation of the strategies for infrastructure development and allocation of resources, especially in North Bengal, to guarantee that all students have access to equitable educational opportunities. Enhancing the quality of school infrastructure can contribute to a more equitable educational landscape in the region. The government should provide more funding to build new schools and educational facilities. This study will assist policymakers and other stakeholders in formulating policies and developing educational infrastructure.

Declaration of conflict of interest

The authors declare that there is no conflict of interest

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