Available Online at ESci Journals
Journal of South Asian Studies
ISSN: 2307-4000 (Online), 2308-7846 (Print)
http://www.escijournals.net/JSAS

ASSESSING THE ENROLLMENT AND PRIMARY EDUCATIONAL INFRASTRUCTURE OF RURAL WEST BENGAL, INDIA: A DISTRICT LEVEL ANALYSIS

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A B S T R A C T

The paper examines the enrollment of rural primary school of West Bengal and its Physical Infrastructure using the data of District Information System for Education data (DISE) 2012-13. It also tries to explore the relationship between the enrollment and school physical infrastructure. School infrastructure includes the drinking water facility, presence of the library at school, accessibility of functioning toilet for both girls and boys, mid-day meal scheme, availability of electricity, playground and separate kitchen at the school. High enrollment in some districts indicates the presence of fictitious student. It is found that there is a high correlation between enrollment and school physical infrastructure, midday meal, drinking water and presence of a teacher at the school is crucial for high enrollment at the rural primary school.

Keywords: Accessibility, Enrollment, Fictitious Student, India, Primary Education, Rural West Bengal, School Infrastructure.

INTRODUCTION

Place of education in the current rural development debate is very crucial. The rural dimension of basic education issues in most developing countries was largely overlooked in the 1990s (Atchoarena & Gasperin, 2003). In September 2000, world leaders came together at the United Nations Headquarters and adopted the United Nation Millennium Declaration. They set out a series of eight time-bound targets - with a deadline of 2015 - that have become known as the Millennium Development Goals (MDGs). Improving the primary school enrolment rate in the developing regions was one of the important goals of MDGs. In India with a view to enhance enrollment, retention and attendance and simultaneously improving nutritional levels among children, the National Programme of Nutritional Support to Primary Education (NP-NSPE) was launched as a Centrally Sponsored Scheme in 1995, initially in 2408 blocks in the country. By the year 1997-98 the NP-NSPE was introduced in all blocks of the country. Later it was revised and in 2004 Mid-Day Meal (MDM) scheme was introduced. The primary objective of this scheme was to give boost to universalization of primary education and to impact the nutritional intake of students in primary classes (Deodhar & Mahandiratta, 2010). It is believed that mid-day meal alone cannot hold the high enrollment as well as retention rate of a school. There are other factors equally important in keeping high enrollment as well as retention. According to the Pratham's annual status of education report: 2014, suggests that 96.7% children (in the age group 6-14 years) are enrolled in rural India. Report also suggests that attendance in the month of September to October is only 71%. However there is a variation of attendance across the state. Bihar, Uttar Pradesh, and West Bengal have reported lowest attendance rates. Apart from the attendance enrollment in rural private schools is increasing day by day. In west Bengal enrolment at rural private school was 3.7% in 2006 which in 2014 increased to 8.4%. It is worthwhile to mention that this figures reached more than 50% in some states like UP (52.8%) and Haryana (53.8%) in 2014 (ASER, 2014).

STUDY OBJECTIVE

The paper tries to focus on physical infrastructure of the rural primary school in West Bengal and identify

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the groups which are in disadvantageous position across the districts with respect to the enrollment in primary schools. Apart from this the paper also tries to explore the relationship between the enrollment and school physical infrastructure. Unified District Information System for Education data (U-DISE) 2012-13 has been used to analyze the situation. School infrastructure includes drinking water facility, availability of library at school, accessibility of functioning toilet for both girls and boys, mid-day meal scheme, availability of electricity, playground and separate kitchen at school.

METHODOLOGY

Gross enrolment ratio across the different districts has been calculated. It is calculated using the total primary school (both private and public) enrollment within a district divided by the total number of child in the official age group corresponding to this level of education. Composite indicator of school physical infrastructure is prepared. The variable includes AT- Availability of Teacher per school, SDW- Supply of Drinking water, and SE- Supply of Electricity, PL- Presence of Library, EPG- Existence of Playground, MDM- Mid Day Meal, SK- Separate Kitchen, and FT- Functioning Toilet. A correlation is drawn between enrolment and above mentioned school infrastructure. Analyzed data has been presented in tables, maps and suitable diagrams. Lastly a principal component analysis is performed to see correlation of the factors of enrolment. Principal component analysis (PCA) is a statistical technique for dimension reduction. It helps to reduce the number of variables in an analysis by describing a series of uncorrelated linear combinations of the variables that contain most of the variance. The objective of PCA is to find unit-length linear combinations of the variables with the greatest variance. The first principal component has maximal overall variance. The second principal component has maximal variance among all unit length linear combinations that are uncorrelated to the first principal component, etc. If there are m indicators, the observed value of each indicator is n, so the principal component analysis model is established as follows (Yang and Zhang, 2013)

$$\begin{cases} Z_1 = a_{11}X_1 + a_{21}X_2 + \ldots + a_{n1}X_n \\ Z_2 = a_{12}X_1 + a_{22}X_2 + \ldots + a_{n2}X_n \\ \qquad\qquad \ldots\ldots\ldots\ldots (1) \\ \qquad\qquad . \\ Z_m = a_{1m}X_1 + a_{2m}X_2 + \ldots + a_{n\,m}X_n \end{cases}$$

In (1) a_{1i}, $a_{2i\ldots}$ a_{ni} (i= 1, 2…m) is the characteristic vector of the characteristic value of the covariance matrix of X, and X_1 , X_2 , X_n is the standardized variable of X.

$a= (a_{ij})_{mxn} = a_1, a_2\ldots..a_n$, $R_{ai}= \lambda_i a_i$ *R* is the correlation coefficient matrix, λ_i is the corresponding characteristic value, a_i is the unit orthogonal vector, and $\lambda_1 \geq \lambda_2 \geq \ldots\ldots \geq \lambda_n \geq 0$.

Following enrollment factors of a primary school are analyzed by principal component method. X1= Availability of Teacher, X2= Supply of drinking water at school, X3= Supply of Electricity, X4= Presence of Library, and X5= Existence of Playground, X6= Mid Day Meal served, X7= Separate Kitchen at the School, X8= Functioning Toilet. Obtained total variance explained in the following table 5. STATA 11 software is used for PCA and Correlation.

FINDINGS AND DISCUSSIONS

Enrolment and Some Critical Issues of Primary School Education: One of the important criteria of development is the education for all. In April 2000, representatives of 164 countries, including India, met at Dakar, Senegal, to discuss and consider these issues. At the conclusion of the Conference, the following six goals were adopted by the international communities which known as the Education for All (EFA) goals (Rena, 2007). One of these goals was to offer complete free and compulsory primary education of good quality to children of that age group (6-14years). In line with the declaration, government passed free and compulsory education act 2004. To make universalization of elementary education government introduced Sarva Shiksha Abhiyan (GOI, 2005). Enrolment of a child at school is one of the prime conditions of universalization of education. District wise enrolment ratio of rural West Bengal is given in the following table. See Table 1.

Table 1. Rural Gross Enrolment Ratio across the Different Districts of West Bengal 2012-13.

District	Gross Enrolment ratio*	Gross Enrolment ratio**	District	Gross Enrolment ratio*	Gross Enrolment ratio**
Bankura	0.88	0.42	Maldah	0.67	0.32
Bardhaman	0.78	0.36	Murshidabad	0.79	0.38
Birbhum	1.52	0.73	Nadia	2.31	1.06
South Dinajpur	2.80	1.29	North 24 Parganas	0.89	0.41
Darjeeling	1.59	0.75	Paschim Medinipur	1.04	0.50
Haora	1.54	0.73	Purba Medinipur	0.94	0.44
Hooghly	1.07	0.49	Puruliya	1.10	0.55
Jalpiguri	1.04	0.49	Kochbihar	1.50	0.70
North Dinajpur	1.19	0.59	South 24 Parganas	1.12	0.54

Source: Census of India 2011, and DISE, Data calculated and compiled by author

Note:*Enrolment ratio calculated the total primary school enrolment divided by child ages between 5-9 years.

** Enrolment ratio calculated the total primary school enrolment divided by child ages between 5-14 years.

Here Gross enrollment Ratio is calculated.

Table 1 shows that enrolment ratio of certain district are more than 1. Normally the ratio should be equal to one. Here 1 indicates the 100 percent enrolment. Highest enrolment is found in Dakshin Dinajpur (2.80) and Nadia (2.31) district. These numbers are exaggerated because the actual enrolment is not as high as it depicted. It is also mentioned in the interim report of Restructuring of School Education System in West Bengal published from IIM Calcutta in 2011 (IIMC, 2011). The report Gross Enrollment Ratio is based on 2008-09 data of DISE. This phenomenon has been noticed in other states of India like Maharastra. In August 2011, the department of education, Government of Maharashtra had conducted a survey of the enrolment rates for Standards 1 to 12. They found the rising tendency of number of bogus students. This survey showed that around 20% of the students on the rolls did not exist. It also found that these missing students were fewer in government schools than in grantable schools (the schools typically started by local politicians). The report also reveals that in the backward districts has higher percentage of bogus students than in the more advanced districts (Sathe, 2012). If we look at West Bengal almost similar things can be found. Due to low enrolment at grantable school government may declare the school as sick and reduce various funds. So this fear of fund reduction is one of the reasons for high and fictitious enrolment ratio. Almost all the backward district of west Bengal have more than 1 enrolment ratio which include Puruliya, Jalpiguri, Daksin Dinajpur. Though there are some backward districts which have enrolment ratio less than 1. This district includes Murshidabad, Malda and Bankura. The extent of fictitious student is so high that even when we increase the age range (5-14) the enrolment ratio still more than one in two districts which include Nadia (1.06) and Dakshin Dinajpur (1.29). It has been done to capture the extent of fictitious student in the districts.

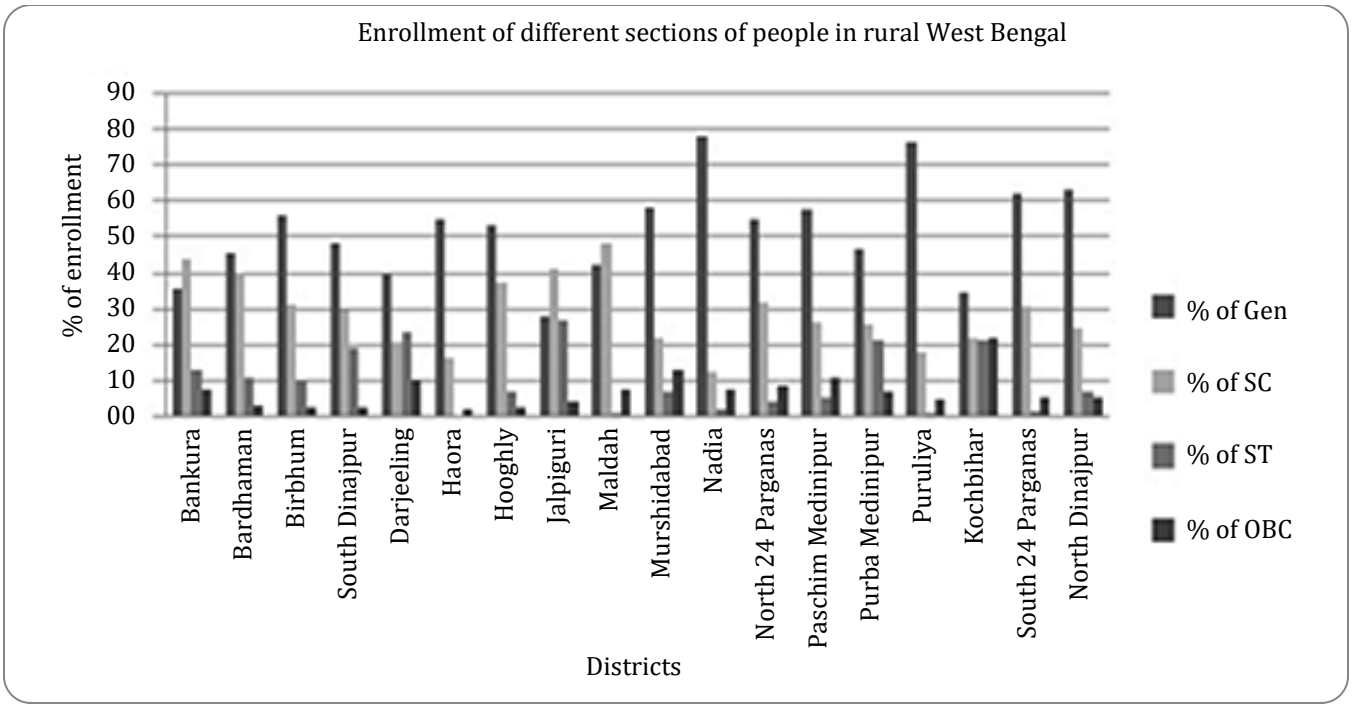


Figure 1. Enrollment of different sections of people in rural West Bengal.

Community wise enrolment at rural primary school shows that Murshidabad (77.86%), Purba Medinipur (76.29%) and North Dinajpur (63.33%) hold the first, second and third position respectively in terms of general category student enrolment. Schedule Caste student enrolment is lowest in Murshidabad (12.57) on the other hand Howrah occupied last position in both Schedule Tribe and Other Backward Class student enrolment. Koch Bihar (48.60%) holds first position in terms of Schedule caste student enrolment while Jalpaiguri (26.63%) hold top position in terms of Schedule Tribe student enrollment.

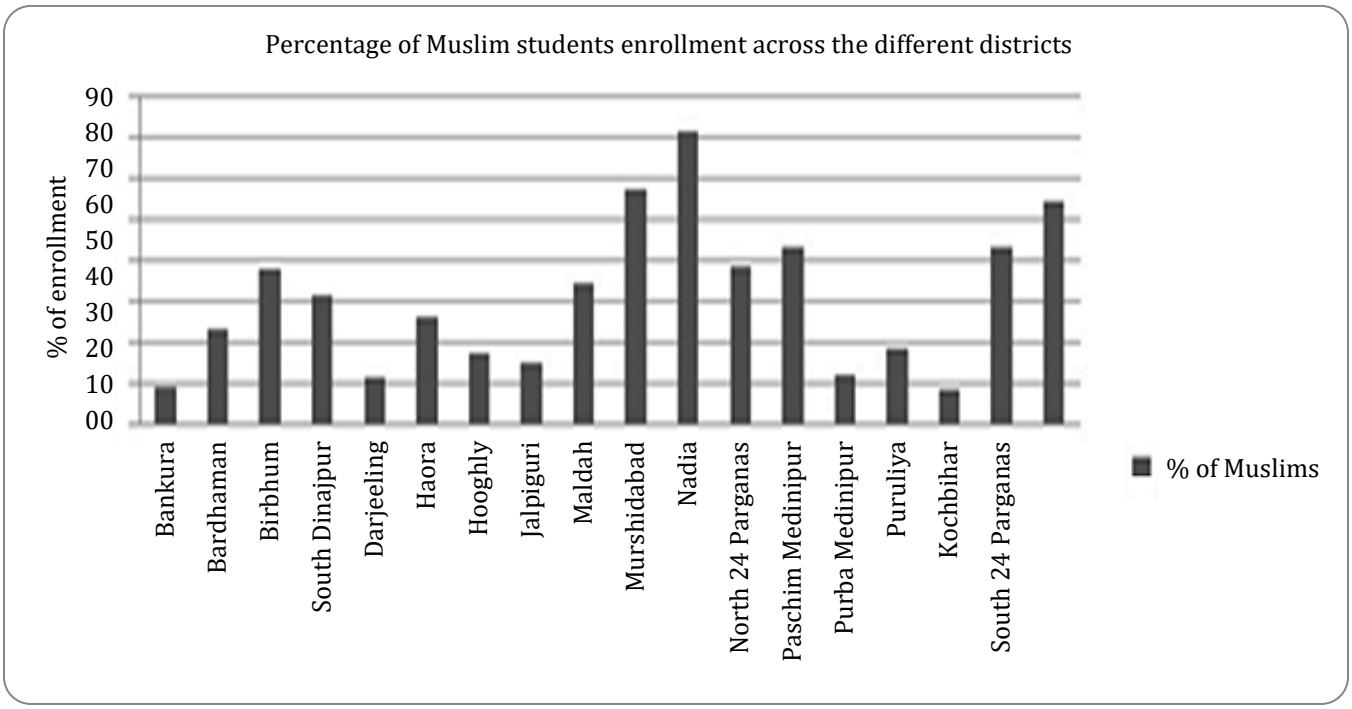


Figure 2. Percentage of Muslim students enrollment across the different districts. Source: DISE, 2012-13

Murshidabad, North Dinajpur and Maldah district holds top three positions in total Muslim population of the state. Primary school enrolment in these three districts is highest. Data shows that enrolment of SC and ST are high in the backward districts like Bankura, Puruliya, Jalpiguri and Birbhum. It suggests that despite backwardness the enrolment is very high. It is probably for Mid Day Meal programme. In Karnataka it has been found that there is a correlation between mid day meal and high enrolment especially in backward districts (Laxmaiah & Sama et al. 1999).

Table 2. Number of Schools and Availability of Teachers.

District	Average no. of Teacher/ school	School per sq km	District	Average no. of Teacher/ school	School per sq km
Bankura	2.32	0.72	Howrah	3.78	1.83
Burdwan	2.85	0.89	Hooghly	3.08	1.33
Birbhum	2.83	0.90	Jalpiguri	3.02	0.73
South Dinajpur	2.77	1.04	Kochbihar	2.91	1.04
Darjeeling	2.66	0.83	Maldah	3.28	1.06
Murshidabad	3.14	1.24	Paschim Medinipur	2.77	1.28
Nadia	3.08	1.06	Purba Medinipur	2.52	0.87
North 24 Parganas	2.81	1.36	Puruliya	2.20	0.71
North Dinajpur	3.18	1.01	South 24 Parganas	3.02	0.67

Source: DISE 2012-13, data calculated and complied by author.

Both number of teachers and number of schools are important component for student enrolment. Their availability and accessibility is crucial for enrolment. In rural Bengal there are 8 districts where number of school (both government and private) per sq km is less than 1. These districts are Bankura, Puruliya, Purba Medinipur, South 24 Pgs, Birbhum, Burdwan, Darjeeling and Jalpiguri. It is apparent that almost all the districts are backward except Burdwan. It is to be noted that out of the 8 district some districts have geographical inaccessibility which include existence of hill, forest and Remote Island. Availability of teacher per school is more than 2 in all the districts but it is also found that there are number of grantable government schools across all the districts where there is no presence of teacher. Therefore, lack of teacher at government primary school is a serious issue for further development of the school. Apart from this, mal-distribution of teachers across the district is very common pointed out in the report "The Possibility of RTE in West Bengal: An action-research in five districts of West Bengal" published by the Pratichi Institute (PI, 2013). It is to be noted that according to the Right to Education Act (RTE) 2009 every school should have adequate teachers and at least one classroom for every teacher (GOI, 2009). In district level analysis it found that this provision of one classroom for every teacher is not being maintained specially in backward districts.

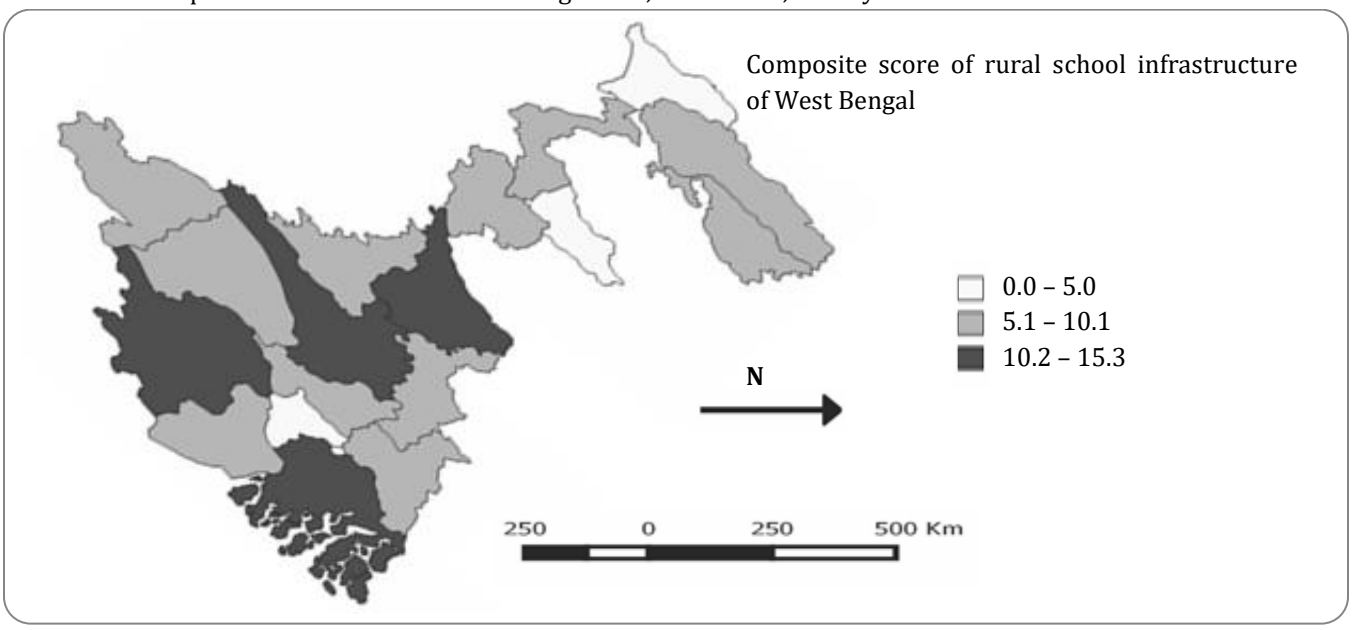
District Level Analysis of Infrastructure of School: According to the Right to Education Act (RTE) 2009 every school should have an all-weather building, adequate teachers, at least one classroom for every teacher, separate toilets for boys and girls, safe and adequate drinking water facility, a playground, a kitchen for the mid-day-meal and arrangements for keeping the school building secure by boundary wall or fencing. In fact, these are the basic minimum facilities that a school should have. So this paper have taken at least six indicators including the availability of teacher, availability of drinking water, toilet, electricity, library, playground, separate kitchen for mid-day meal and mid-day meal supply. On the basis of these indicators a composite indicator of school infrastructure across the districts have been prepared to compare inter-district school infrastructure. The observations for each indicator are divided by the mean to get rid of the bias of scale without affecting the relative position of the districts in the series. This transformation does not disturb the 'dispersion' of the indicators since the co-efficient of variation (CV) of the original series is retained as the standard deviation (or the CV) of the transformed series (Kundu et al. 2002). Then added the scale free value of each indicator of a district and cumulative value represent the ultimate score of the district.

Table 3. Unweighted Composite Score of School Infrastructure of Districts of West Bengal.

District	Composite Value of School Infrastructure	District	Composite Value of School Infrastructure
Bankura	9.13	Kochbihar	6.76
Burdwan	11.46	Maldah	6.36
Birbhum	7.43	Murshidabad	11.44
South Dinajpur	4.40	Nadia	6.86
Darjeeling	3.31	North 24 Parganas	10.08
Howrah	4.96	Paschim Medinipur	15.29
Hooghly	7.11	Purba Medinipur	10.00
Jalpiguri	6.58	Puruliya	5.88
North Dinajpur	5.32	South 24 Parganas	11.27

Source: DISE 2012-13, data calculated and complied by author.

It is evident from the table 3 that there are three districts whose composite score is less than 5. These districts are South Dinajpur, Howrah and Darjeeling. It suggests that these three districts have very poor primary school infrastructure. There are 11 districts which have medium school infrastructure; districts include Puruliya, Bankura, North 24 Pgs, Nadia, Malda, Jalpiguri, Koch Bihar and North Dinajpur. The top four districts are Burdwan, Murshidabad, Paschim Medinipur and South 24 Pgs. It is worthwhile to note that despite the backwardness of districts like Murshidabad, Paschim Medinipur and South 24 Pgs rural primary school infrastructure is comparatively better. Now if we look at the score of individual indicator of the top districts, there is some interesting fact which needed to be mentioned. In Paschim Medinipur number of schools running MDM, school having separate kitchen, availability of library, playground, drinking water and toilet facility is in better position. It means more than average schools have these facilities. Though the number of teachers and supply of electricity is not as good as others facilities. The Other aspects that we can look at, is there any pattern in individual indicator across the 18 district. Close look at the individual indicators reveal that backward districts schools have lack of drinking water supply as well as the toilet facilities. Moreover there is a correlation between drinking water supply and toilet facilities. Those districts have lack of drinking water supply also have lack of toilet facility. Apart from this supply of electricity is also not adequate in backward districts. These districts are Birbhum, South Dinajpur, Darjeeling, Jalpiguri, Kochbihar, Maldah, Puruliya.



Map-1 Composite Score of Rural School infrastructure in West Bengal.

Correlation between school Enrollment and school Infrastructure: It is well known that adequate physical infrastructure at school makes positive difference to teachers' attitude to work (Agwarwal et al. 2007). It has been found in an earlier study that a positive correlation exists between the availability of adequate school infrastructure and infrastructure surrounding the school and enrollment in school, especially in respect of the girl child (Drèze and Kingdon, 2001). In our paper, we also try to see whether physical infrastructure has any correlation with enrolment in rural primary school.

Table 4. Correlation Between school Enrollment and school Infrastructure.

	En	A T	SDW	SE	PL	EPG	MDM	SK	FT
En	1								
AT	0.72	1							
SDW	0.69	0.95	1						
SE	0.45	0.79	0.82	1					
PL	0.69	0.79	0.81	0.61	1				
EPG	0.51	0.73	0.63	0.46	0.52	1			
MDM	0.72	0.92	0.88	0.73	0.82	0.7	1		
SK	0.71	0.93	0.92	0.74	0.82	0.74	0.97	1	
FT	0.7	0.87	0.94	0.87	0.8	0.53	0.79	0.83	1

Source: Calculated by author.

Note: En- Enrollment, AT- Availability of Teacher, SDW- Supply of Drinking water, SE- Supply of Electricity, PL- Presence of Library, EPG- Existence of Playground, MDM- Mid Day Meal, SK- Separate Kitchen, FT- Functioning Toilet,

It is apparent from the table that there is a high correlation between enrollment and midday meal, followed by enrolment with separate kitchen where the mid-day meals supposed to cook. Apart from this availability of teacher, functioning toilet and enrollment also have a high correlation. In all this case correlation value is either 0.7 or more. Comparatively weak correlation has been found between enrollment and supply of electricity. There is a high correlation between functioning toilet and supply of water. Other than the enrolment, availability of teachers and the almost all the variables have high correlation except with the existence of playground at school. In this case the correlation value is either 0.79 or more. It is comparatively lower in case of the existence of the playground at school i.e. 0.73.

Assessment of the Factors of Enrollment

To assess the enrolment factor Principal Component Analysis is used. The data in table 5 shows the cumulative explained variance of the first two principal components, i.e. the sum of the largest eigenvalues normalized by the total sum of the eigenvalues. The eigenvalues add up to the sum of the variances of the variables in the analysis—the "total variance" of the variables. Because we are analyzing a correlation matrix, the variables are standardized to have unit variance, so the total variance is 8.

Table 5. Variance Explained by the Principal Components.

Component	Eigen value	Proportion	Cumulative
Component 1	6.56	0.82	0.82
Component 2	0.65	0.08	0.90

Source: Calculated by author.

The eigenvalues are the variances of the principal components. The first principal component has variance 6.56, explaining 82% (6.56/8) of the total variance. The second principal component has variance 0.65 or 0.08% (0.65/8) of the total variance. In general, we are interested in keeping only those principal components whose eigenvalues are greater than 1. Components with an eigenvalue of less than 1 account for less variance than did the original variable (which had a variance of 1), and so are of little use. It suggests that first component is so strong in explaining the variance of enrolment at rural primary school of West Bengal.

Table 6. Correlation between Principal Component and Original Variables.

Variables	Component 1	Component 2
Availability of Teacher	0.37	0.06
Supply of Drinking water	0.37	-0.13
Supply of Electricity	0.32	-0.44
Presence of Library	0.33	-0.08
Existence of Playground	0.28	0.77
Mid Day Meal	0.37	0.14
Separate Kitchen	0.37	0.15
Functioning Toilet	0.36	-0.35

Source: Calculated by author.

To interpret each component, we compute the correlations between the original data for each variable and each principal component. These correlations are obtained using the correlation procedure. Here a correlation value above 0.3 is deemed important as it indicates strong correlation with each component i.e. the farthest from zero in either positive or negative direction. The first principal component is strongly correlated with 7 of the original variables. The first principal component increases with increasing availability of teacher, supply of drinking water, supply of electricity, presence of library, Mid-Day Meal (MDM) service, separate kitchen and functioning toilet scores. This suggests that these seven criteria vary together. If one increases, then the remaining two also increase. This component can be viewed as a measure of availability of teacher, supply of drinking water, supply of electricity, presence of library, Mid-Day Meal (MDM) service, separate kitchen and functioning toilet scores. Furthermore, we see that the first principal component correlates most strongly with the availability of teacher, supply of drinking water, Mid-Day Meal (MDM) service, and separate kitchen at the school. It could be stated that based on the correlation of 0.37 that this principal component is primarily a measure of the four above mentioned variables. It would follow that in schools with higher availability of teacher, supply of drinking water, Mid-Day Meal (MDM) service, and separate kitchen there would more enrollments at school. It is because these are very basic things for primary rural quality education. The second principal component increases with only one of the values, increasing existence of playground. This component is not as important as earlier noted.

CONCLUSION

This paper tried to find out the enrollment of rural primary school of West Bengal and it shows that there is a huge discrepancy between enrollment and the actual number of the child population existed in the district. Apart from this paper also analyzes the spatial variation of the enrolment rate across the different social groups. Spatial disparity of Physical infrastructure of school has also been analyzed district wise. Positive Correlation with enrollment and school physical infrastructure suggest that physical infrastructure has a crucial role for both students and teachers. Principal Component Analysis shows that mid-day meal, availability of teacher and drinking water at school are the most crucial factor for rural enrollment. However it is undoubtedly admitted that apart from physical infrastructure at the school there are other external factors which is also important for enrollment.

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