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INTER RELATIONSHIP BETWEEN EDUCATIONAL INFRASTRUCTURE AND EDUCATIONAL DEVELOPMENT IN INDIA – STATEWISE ANALYSIS

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INTRODUCTION

Infrastructure is generally defined as the physical framework of facilities through which goods and services are provided to the public. Its linkages to the economy are multiple and complex, because it affects production and consumption directly, creates positive and negative spillover effects (externalities) and involves large flows of expenditure (Prasad etal 2007).

The availability of adequate infrastructure facilities is vital for the acceleration of the economic development of a country. Governments have traditionally been well aware of this and have accorded high priority to investment in sectors such as railways, roads, power, telecommunication, ports, water supply, sanitation etc. Infrastructure services are often monopolistic in nature, they usually involve high upfront costs and long payback periods and investments are typically bulky and lumpy (Raj Kapila and Uma Kapila, 2002).

Educational infrastructure enhances the quality of life since education enables human beings to understand the interrelationship among the tangible and intangible phenomena surrounding them and gives skill to translate the knowledge into action. Acquisition of education helps workers to take advantage of technical changes, which increases their productivity and earnings. (Asok Basu, 2002). The provision of education creates both private benefits and spillover benefits to society. As such, education emerged as a key form of investment in human beings (Duraisamy, 2002) in the countries.

Educational infrastructure comprises of schools, teachers, class rooms, availability of drinking water facility and toilet facility. The educational infrastructure index takes into account average student-classroom ratio, pupil teacher ratio, percentage of schools with drinking water

facilities, percentage of schools with separate toilets for boys and girls as required and percentage of schools having computer facilities.

In India the number of primary schools increased from 6.64 lakh in 2001 – 02 to 7.68 lakh in 2004 – 05. In the same period, the number of upper primary schools increased at a faster rate from 2.20 lakh to 2.75 lakh. The share of government and local body schools and private aided schools showed an increase from 24% in 2001 – 02 to 30% in 2004 – 05. The sanction of 2.23 lakh new primary schools, 1.88 lakh new school buildings and 6.70 lakh additional class rooms in 2004-05 has made a big dent in reducing the school infrastructure gap.

The Eleventh plan document of India (2007-12) listed the following monitorable targets for education.

- Reduce dropout rates of children from elementary school from 52.2% in 2003 – 04 to 20% by 20011 – 12.
- Develop minimum standards of educational attainment in elementary school.
- Increase literacy rate for persons of age 7 years or more to 85 percent.
- Lower gender gap in literacy to 10 percent points and
- Increase the percentage of each cohort going to higher education from the present 10% to 15% by the end of the 11^{th} plan.

The attainment of these targets basically depends upon the availability of the required educational infrastructure and hence, there is a link between educational development and educational infrastructure. In India many research studies- Bhatt (2002), Dash (2004), Srinivasan (2004) etc have analyzed the educational development in India. But there had been little attempt focused on analyzing the link between educational infrastructure and educational development. Hence as a pioneering effort the research study on "Inter relationship between educational infrastructure and educational development in India – State wise analysis" was formulated. The objectives of the study were,

- To find out the interstate variations in educational infrastructure;
- To find out the interstate variations in educational development;
- To find out the inequality in educational infrastructure and educational development among the states and
- To find out the impact of educational infrastructure on educational development.

METHODOLOGY

The study was related to 17 Major States of India: Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. The required data on number of schools, number of teachers , pupil teacher ratio, average number of classrooms, average student class room ratio, percentage of schools having drinking water facility, percentage of schools having toilet facilities, literacy rate, gross enrolment rate and dropout rate were collected from the following sources:

- Census of India - 2001
- Selected educational statistics- 2007-08 and
- Report of elementary education in India – Progress towards universal elementary education 2009-10

The study is related to 2008-09 and 2009-10 since it is the latest year for which the required data are available. The study is related to primary and upper primary school infrastructure and enrolment at the same level.

Educational infrastructural index is based on the indicators of number of schools, number of class rooms, student class room ratio, number of teachers, teacher pupil ratio, percentage of schools having drinking water facility and toilet facility. The current study tried to adopt the educational development index developed by National University of Educational Planning and Administration and the Government of India Ministry of Human Resource Development (MHRD), Department of School Education and Literacy.

Construction of educational development index:

Following Nauriyal and Sahoo (2010) the study tried to estimate the educational development index as follows by adding the enrolment rate at various levels of and using the formula,

$$EDI = \frac{2*\text{Literacy rate} + \text{Gross enrolment index}}{3}$$

$$\text{Literacy index} = \frac{\text{Actual literacy rate} - \text{Minimum literacy rate}}{\text{Maximum literacy rate} - \text{Minimum literacy rate}}$$

Where, Maximum value = 100

Minimum value = 0

Similarly, gross enrolment index of the state is calculated as follows,

Gross enrolment index = Actual gross enrolment – Minimum gross enrolment

Maximum gross enrolment – Minimum gross enrolment

Actual gross enrolment is computed by adding up of enrolment at different levels of schooling. Maximum value = 100 and minimum value = 0.

The educational development index varies from 0 to 1. The states having score close to 1 is performing better while the states having value close to zero is the worst performer.

HYPOTHESIS FORMULATED

1. There is no disparity in educational infrastructure and educational development among the various States and
2. There is no significant impact of educational infrastructure on educational development.

QUANTITATIVE TOOLS USED

1. Theils inequality index:

   This was used to find out the inequality in the various components of educational infrastructure and educational development. The formula used was

   $Y = \text{Log}(n) - y^{*}\log(1/y)$

2. Multiple regression analysis:

   To identify the impact of educational infrastructure on educational development multiple regression analysis of the following form was used.

   $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7$

   Where Y= Educational development index;

   X1=Number of schools;

   X2= Average number of class rooms

   X3= Average student-classroom ratio;

   X4=Number of teachers;

   X5= Pupil teacher ratio;

   X6= Percentage of schools having drinking water facilities;

   X7= Percentage of schools having toilet facilities and

E = Error term

β1 to β57 are estimated multiple regression co- efficient.

FINDINGS OF THE STUDY

A) INTERSTATE VARIATIONS IN EDUCATIONAL INFRASTRUCTURE:-

Table I represents the number of schools in various states of India.

TABLE – I

NUMBER OF SCHOOLS IN VARIOUS STATES OF INDIA

S.No	State	2008-09			2009-10		
		Number of Government Schools	Number of Private Schools	Total	Number of Government Schools	Number of Private Schools	Total
1	Andhra Pradesh	79550	21753	101303	79813	22985	102798
2	Assam	60147	8395	68542	44518e	8820	53338
3	Bihar	67649	93	67742	67618	14d	67632
4	Gujarat	33182	5924	39106	33425	6513	39938
5	Haryana	15460	3480	18940	15153	3424	18577
6	Himachal Pradesh	15071	2289	17360	15091	2317	17408
7	Jammu & Kashmir	20866	4549	25415	21310	4786	26096
8	Karnataka	46199	11318	57517	46325	11834	58159
9	Kerala	5042	7302	12344	5095	7327	12422
10	Madhya Pradesh	109757	22989	132746	111510	23455	134965
11	Maharashtra	65979	26069	92048	67573#	26551	94124
12	Orissa	55713b	6447	62160	53041	3732	56773
13	Punjab	19326	2549	21875	19967	3303	23270
14	Rajasthan	81058	24027	105085	79603d	24767	24767
15	Tamil Nadu	35436	18454	53890	35616	18812	54428
16	Uttar Pradesh	140219	46474	186693	147042	48019	195061
17	West Bengal	57344	13427	70771	77181	11362	88543

Source: Report of elementary education in India – Progress towards universal elementary education 2009-10

c : Total may not add to %age Private Schools because of rounding of figures. d : Incomplete Coverage. # : Including EGS. e : Number declined because of up gradation of a few primary schools. b : Including schools having Grade VIII which is part of secondary level. @ Total may

not add to 100 because of missing values and rounding of figures. @@ Government & Private schools may not add to total number of schools because of missing values.

In 2008-09 the number of Government schools was the highest in Uttar Pradesh and lowest in Kerala. Similarly the number of private schools was the highest in Uttar Pradesh and lowest in Bihar. The total number of schools was the highest in Uttar Pradesh (186693) and lowest in Kerala (12344). In 2009-10 the number of Government schools was the highest in Uttar Pradesh and lowest in Kerala and the number of private schools was the highest in Uttar Pradesh and lowest in Jammu and Kashmir. The total number of schools in 2009-10 was the highest in Uttar Pradesh (195061) and lowest in Kerala (12422).

Table II represents the average number of class rooms and average student-classroom ratio in various states of India.

TABLE – II

AVERAGE NUMBER OF CLASS ROOMS AND AVERAGE STUDENT-CLASSROOM RATIO (SCR)

S.No	State	Average Number of Class rooms				Average Student-Classroom Ratio (SCR)	
		Primary Schools		All Schools		All Schools	
		2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
1	Andhra Pradesh	2.8	2.9	4.4	4.4	25	24
2	Assam	1.8	2.6	2.5	3.2	35	30
3	Bihar	2.0	2.1	2.9	3.1	96	89
4	Gujarat	2.9	2.7	5.7	5.7	34	35
5	Haryana	4.5	4.4	5.7	5.7	30	32
6	Himachal Pradesh	3.1	3.1	4.0	4.0	15	15
7	Jammu & Kashmir	2.3	2.3	4.4	4.5	17	17
8	Karnataka	2.5	2.5	5.1	5.2	27	25
9	Kerala	6.0	5.8	10.8	10.0	25	27
10	Madhya Pradesh	3.1	3.1	3.7	3.8	31	30
11	Maharashtra	3.0	2.9	5.5	5.4	31	31
12	Orissa	2.6	2.6	3.6	3.5	30	30
13	Punjab	3.6	3.6	5.3	5.5	24	23
14	Rajasthan	2.7	2.8	4.6	4.9	25	24
15	Tamil Nadu	4.5	4.3	6.6	6.6	28	27
16	Uttar Pradesh	4.1	4.2	4.4	4.5	39	36
17	West Bengal	2.9	3.1	3.9	4.0	47	42

b Excluding AIE C centres. ** Excluding AIE centres. State has closed down 8772 AIE Centres & 6476 Venture schools.

In 2008-09 the number of teachers in all schools was the highest in Uttar Pradesh (651338) and lowest in Himachal Pradesh (63363). Similarly in 2009-10 the number of teachers in all schools was the highest in Uttar Pradesh (697890) and lowest in Himachal Pradesh (64638).

The availability of drinking water facility and toilet facility are the essential infrastructure facilitating educational development. Table IV represents the availability of drinking water facility and toilet facilities in all schools in various States of India.

TABLE – IV

AVAILABILITY OF DRINKING WATER FACILITY AND TOILET FACILITY IN VARIOUS STATES OF INDIA

S.No	State	% Schools having Drinking Water Facility		% Schools having Toilet Facility	
		All Schools		All Schools	
		2008-09	2009-10	2008-09	2009-10
1	Andhra Pradesh	85.59	91.83	61.45	74.30
2	Assam	65.34	81.33	30.27	41.75
3	Bihar	85.32	92.60	57.19	48.24
4	Gujarat	90.24	96.74	73.10	37.49
5	Haryana	96.99	99.48	94.80	56.64
6	Himachal Pradesh	94.10	97.64	50.86	38.14
7	Jammu & Kashmir	78.66	86.31	35.27	33.93
8	Karnataka	71.70	85.44	83.29	88.15
9	Kerala	97.73	98.99	82.88	55.86
10	Madhya Pradesh	92.69	94.03	74.20	55.62
11	Maharashtra	87.70	93.73	77.14	32.49
12	Orissa	83.33	89.07	57.15	80.79
13	Punjab	97.32	98.76	89.17	86.78
14	Rajasthan	91.96	96.44	48.65	55.98
15	Tamil Nadu	100.00	99.87	66.74	47.90
16	Uttar Pradesh	97.58	98.18	92.65	43.95
17	West Bengal	82.71	96.02	74.34	79.96

Source: Report of elementary education in India – Progress towards universal elementary education 2009-10

In 2008-09 Tamil Nadu was a leading state with regard to availability of drinking water facility in the schools since all schools had drinking water facilities. However, in Assam only 65.34% of schools had drinking water facilities. In 2009-10 in Tamil Nadu 99.87% of the schools had drinking water facilities, while in Assam only 81.33% of schools had drinking water facilities.

Source: Report of elementary education in India – Progress towards universal elementary education - 2009-10

The average number of class rooms for all schools in 2008-09 was found to be the highest in Kerala (10.8) and lowest in Assam (2.5). The same thing was noticed in 2009-10.

In 2008-09 the average student- class room ratio was found to be the highest in Bihar (96) and lowest in Himachal Pradesh (15). Similarly in 2009-10 the average student-classroom ratio was found to be the highest in Bihar (89) and lowest in Himachal Pradesh.

Table – III represents the number of teachers and pupil-teacher ratio in various states of India.

TABLE - III

NUMBER OF TEACHERS AND PUPIL-TEACHER RATIO IN VARIOUS STATES OF INDIA

S.No	State	Number of Teachers		Pupil-Teacher Ratio	
		All Schools		All Schools	
		2008-09	2009-10	2008-09	2009-10
1	Andhra Pradesh	508004#	501819	21	22
2	Assam	261212	225857b	22	23
3	Bihar	338478	332834	55	57
4	Gujarat	238030	243342	32	32
5	Haryana	116239	110134	28	30
6	Himachal Pradesh	63363	64638	17	16
7	Jammu & Kashmir	124324	124127	15	16
8	Karnataka	267094	279086	29	27
9	Kerala	132805	137182	25	24
10	Madhya Pradesh	435723	441063	36	35
11	Maharashtra	581257	533297	27	30
12	Orissa	246217#	182026**	27	33
13	Punjab	103383	104049	27	28
14	Rajasthan	453163	458766	27	27
15	Tamil Nadu	327391	330200	30	30
16	Uttar Pradesh	651338	697890	50	45
17	West Bengal	272923	381018a	47	39

Source: Report of elementary education in India – Progress towards universal elementary education 2009-10

* Data not fully reported. State has clarified that all Government & Aided Schools are covered under MDM. NR : Date not Reported.

Including teachers teaching Grade VIII as a part of Secondary level has also been considered.
a Including SSK etc. Institutions.

There exist variations in percentage of schools having toilet facilities. In 2008-09 Haryana had the highest proportion of schools having toilet facility. However in 2009-10 Karnataka had the highest proportion of schools having toilet facility.

Table – V represents the educational infrastructure index in various states of India.

TABLE – V

EDUCATIONAL INFRASTRUCTURE INDEX IN VARIOUS STATES OF INDIA

S.No	State	Educational infrastructure index & Rank			
		2008-09	Rank	2009-10	Rank
1	Andhra Pradesh	0.549	12	0.666	9
2	Assam	0.164	17	0.365	16
3	Bihar	0.379	15	0.375	15
4	Gujarat	0.700	6	0.684	8
5	Haryana	0.872	2	0.847	2
6	Himachal Pradesh	0.595	11	0.654	10
7	Jammu & Kashmir	0.363	16	0.318	17
8	Karnataka	0.680	8	0.596	12
9	Kerala	0.848	3	0.846	3
10	Madhya Pradesh	0.637	10	0.535	14
11	Maharashtra	0.674	9	0.732	5
12	Orissa	0.489	14	0.570	13
13	Punjab	0.883	1	0.969	1
14	Rajasthan	0.686	7	0.691	7
15	Tamil Nadu	0.747	5	0.801	4
16	Uttar Pradesh	0.827	4	0.713	6
17	West Bengal	0.516	13	0.609	11

Source: Report of elementary education in India – Progress towards universal elementary education 2009-10

In 2008-09, Punjab occupied the first rank in educational infrastructure with the index of 0.883 and Assam had the lowest rank with an index of 0.164. In 2009-10, Punjab had the first rank and Jammu & Kashmir had the lowest index of 0.318.

B) INTERSTATE VARIATIONS IN EDUCATIONAL DEVELOPMENT

Educational development is basically related to literacy rate and gross enrolment ratio. Table VI represents the literacy rate in various states of India.

TABLE – VI

LITERACY RATE, GROSS ENROLMENT RATE AND AVERAGE DROP-OUT RATE IN VARIOUS STATES OF INDIA

S.No	State	Literacy rate	Gross Enrolment rate		Average Drop-out Rate at the Primary Level
		2001	2008-09	2009-10	2008-09
1	Andhra Pradesh	54	98.90	100.76	5.75
2	Assam	71	133.52	115.13	9.64
3	Bihar	46	133.43	135.53	13.44
4	Gujarat	69	107.73	109.02	3.86
5	Haryana	65	89.66	92.00	0.15
6	Himachal Pradesh	53	112.12	109.39	2.83
7	Jammu & Kashmir	66	117.25	119.10	3.47
8	Karnataka	63	107.89	107.09	4.11
9	Kerala	91	76.31	75.63	-
10	Madhya Pradesh	56	143.91	139.35	8.20
11	Maharashtra	74	103.83	104.18	3.32
12	Orissa	57	119.97	119.42	6.34
13	Punjab	68	76.19	80.42	4.73
14	Rajasthan	53	116.54	117.07	10.54
15	Tamil Nadu	71	118.52	119.56	0.15
16	Uttar Pradesh	55	109.43	104.84	16.71
17	West Bengal	66	113.33	136.20	8.66

Source: Report of elementary education in India – Progress towards universal elementary education 2009-10

The literacy rate was the highest in Kerala followed by Maharashtra. The lowest literacy rate was found in Bihar. This might be due to differences in educational expenditure among the states. From table VI, it is evident that the gross enrolment ratio at the school level was the highest in Madhya Pradesh (139.35) and lowest in Kerala (75.63). The difference in enrolment might be due to differences in availability of infrastructure facilities. The students enrolled are dropping out from studies due to poverty, family circumstances and long distance school. In 2009-10 drop-out rate was the highest in Rajasthan (10.54) and lowest in Tamil Nadu (0.15).

INTERSTATE VARIATIONS IN EDUCATIONAL DEVELOPMENT INDEX

Table VII represents the estimated educational development index in various states of India.

TABLE – VII

ESTIMATED EDUCATIONAL DEVELOPMENT INDEX IN VARIOUS STATES OF INDIA

S.No	State	2008-09			2009-10		
		Literacy index	Gross enrolment index	Educational development index	Literacy index	Gross enrolment index	Educational development index
1	Andhra Pradesh	0.54	0.98	0.68	0.54	1.00	0.69
2	Assam	0.71	1.33	0.91	0.71	1.15	0.85
3	Bihar	0.46	1.33	0.75	0.46	1.35	0.76
4	Gujarat	0.69	1.07	0.81	0.69	1.09	0.82
5	Haryana	0.65	0.89	0.73	0.65	0.92	0.74
6	Himachal Pradesh	0.53	1.13	0.73	0.53	1.09	0.72
7	Jammu & Kashmir	0.66	1.17	0.83	0.66	1.19	0.83
8	Karnataka	0.63	1.07	0.77	0.63	1.07	0.77
9	Kerala	0.91	0.76	0.86	0.91	0.75	0.86
10	Madhya Pradesh	0.56	1.43	0.85	0.56	1.39	0.83
11	Maharashtra	0.74	1.03	0.83	0.74	1.04	0.84
12	Orissa	0.57	1.19	0.77	0.57	1.19	0.77
13	Punjab	0.68	0.76	0.71	0.68	0.80	0.72
14	Rajasthan	0.53	1.16	0.74	0.53	1.17	0.74
15	Tamil Nadu	0.71	1.18	0.86	0.71	1.19	0.87
16	Uttar Pradesh	0.55	1.09	0.73	0.55	1.04	0.71
17	West Bengal	0.66	1.13	0.81	0.66	1.36	0.89

From table VII, it is evident that in 2008-09 the educational development index at the school level was the highest in Assam (0.91) and lowest in Andhra Pradesh (0.68) and in 2009-10 the educational development index was the highest in West Bengal (0.89) and lowest in Andhra Pradesh (0.69).

C) ESTIMATED THEILS INEQUALITY INDEX OF EDUCATIONAL INFRASTRUCTURE AND EDUCATIONAL DEVELOPMENT.

Table VIII represents the estimated Theils inequality index of the various components of educational infrastructure and educational development.

TABLE – VIII

ESTIMATED THEILS INEQUALITY INDEX OF EDUCATIONAL INFRASTUCTURE AND EDUCATIONAL DEVELOPMENT

S.No	EDUCATIONAL INFRASTRUCTURE			EDUCATIONAL DEVELOPMENT		
	VARIABLES	2008-09	2009-10	VARIABLES	2008-09	2009-10
1	Number of schools	0.0033	0.1093	Literacy rate	0.0056	0.0056
2	Average student class room ratio	0.0462	0.0413	Gross enrolment ratio	0.0058	0.0054
3	Number of Teachers	0.0696	0.0730			
4	Percentage of schools having drinking water facility	0.0025	0.0007			
5	Percentage of schools having toilet facilities	0.175	0.0223			

Table VIII indicates that the estimated Theils inequality index was the highest in the percentage of schools having toilet facility as compared to other components in 2008-09. But in 2009-10 the inequality was found to be the highest in number of schools. However, among the components of educational development there is more inequality in gross enrolment ratio as evident from the estimated Theils inequality index.

D) IMPACT OF EDUCATIONAL INFRASTRUCTURE ON EDUCATIONAL DEVELOPMENT

The current study tried to find out the impact of educational infrastructure on educational development in various states by using multiple regression equation. The estimated multiple regression equation is of the form,

2008-09

$$Y=1.022+0.00012X1+0.026X2+0.002X3+0.0006X4+0.005X5-0.003X6-0.002X7\text{-----}(1)$$

(6.15) (-0.85) (2.80)* (0.689) (0.022) (0.930) (-1.48) (-1.59)

R^2=0.53

N=17

2009-10

Y= 1.279-0.00095X1+0.21X2+0.002X3-0.00048X4+0.004X5-0.006X6-0.001X7------ (2)

(3.26) (0.107) (2.58)* (0.42) (-0.250) (0.648) (-1.35) (-1.05)

R^2=0.62

N=17

The estimated multiple regression equation implies that average number of class rooms was the significant infrastructure variable affecting educational development in 2008-09 and 2009-10.

CONCLUSION

1. Educational infrastructure has a significant impact on educational development in various states.
2. Of the various components of educational infrastructure number of class room is the crucial variable affecting the educational development.

RECOMMENDATIONS

There is need for providing adequate number of class rooms both in Government schools and private schools.

1. More number of teachers should be appointed to achieve the ideal pupil teacher ratio of 1:30 and
2. Proper drinking water facilities and toilet facilities need to be provided in all schools.

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