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A Statistical Study on Educational Development Index for Literacy Parameters of India

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ABSTRACT

India faces the big problem of unemployment, improper trainer and worker, underemployment and unequal distribution of wealth today. These entire problems occur because of low literacy and illiteracy in India. Education is important factor in social economic development to maintain the economic inequality and low income disparity. Effort has been made in this paper to consider six literacy parameters i.e., caste-wise (General, Scheduled Caste and Scheduled Tribe) male and female and analyzed literacy variations among different location, region, sex and castes. Educational Development Index (EDI) has been compared using statistical techniques viz. principle component analysis, composite variable rank and growth index.

Keywords: Literacy rate, principal component analysis, composite variable index, growth index

In world, education is considered as the fundamental element for national development. Literacy is important for national and individual levels. At the national level, a literate population is required to construct a nation with strong social, economic and political foundations. Literacy is an important starting point that brings awareness in people to work towards a better living and at an individual level; it reduces poverty, improves quality of life, helps to attain gender equality and ensures peace, democracy and sustainable development (Literacy of India, Wikipedia). Literacy plays a significant role in the calculation of Education Development Index (EDI). EDI calculate growth of development of state, achievement in socio-economic of state and also measure the standards of living, long and healthy life of person (Katiyar, 2015).

Literacy is main path for social and economic growth in every country. In India, at 1947 the literacy rate was just only 12%. At that time socio-economic growth of India is very low as compared to the other country and India faces big challenge of social, economical and global improvement. After that 2011 census survey, literacy rate goes to 74.04%. This seems like a very huge achievement for India.

The female literacy levels according to the 2011 census are 65.46% where the male literacy rate is over 80%. Among the Indian states, Kerala has the highest literacy rate and then Mizoram ranks second for literacy rate. Bihar has the lowest literacy rate in India with 63.82% (Literacy of India, Wikipedia).

In rural areas lot of children do not get education due to the economic condition of family. So, the government has to make a law that every child under the age of 14 should get free education. Also, the female literacy rate is very low as compare to the male literacy rate as many parents do not allow their daughter to go to schools. In India, to aware people about education, many NGO's and government advertisement, campaigns and programs are held (Desai, 2012).

Attempt has been made in this paper to analysis the educational development index by using three different techniques like principle component analysis, composite variable index and growth index of twenty four states of India and some states are not considered such as Arunachal Pradesh, Punjab, Chandigarh, and Nagaland due to unavailability of information. Lastly, literacy levels of all states have been ranked in descending order and comparison of

these different raking methods of various states are summarized. The specific objectives of the study are (1) to study the level of educational development index of each state based on Principal component analysis; (2) to find out the percentage wise ranking of all states of India by using composite variable ranks; (3) to find out the growth index for the period 2001-2011 and (4) to compare the ranks worked out by using principle component analysis, composite variable rank and growth index.

Literature Review

Petrakis and Stamatakis (2002) have conducted empirical research in a pooled data context to investigate the connection between the growth effect of education and the level of development. The empirical section of this study utilizes the new endogenous growth theory by projecting a corresponding stochastic model for three alternative country groups, one for each development category, and comparing the coefficient of each educational level among the different development categories.

Ahmad and Batul (2013) have analysed and evaluated the poverty and education status in Pakistan. They also discussed on the results of descriptive analyses i.e. unit root test, Johanson Cointegration Test, vector correction error model (VECM), Wald test and Granger causality test on the data of each country for the time period from 1971 to 2011.

Brown and Park (2002) have analyzed household and school survey data from poor countries in six Chinese provinces to examine the effect of poverty, intra-household decision making and school quality on educational investments and learning outcomes. Finally also measure of school quality has some effect on the duration of primary school enrolment but not on learning.

Antonio Villar (2013) proposed a multidimensional index that summarizes three relevant aspects of the educational achievements, out of the data provided by the Programme for International Student Assessment (PISA) report, concerning reading abilities of 15-year-old students from 65 countries. The three aspects considered are performance, equality and quality.

Database and Methodology

We considered the data from the 14th and 15th national census survey for the present study. The data is gathered from the office of the Register, General and Census Commissioner, India under the Ministry of Home Affairs, Government of India. Education Development Index has been constructed by using the R software.

A principle component analysis is concerned with explaining the variance-covariance structure of a set of variables through a few linear combinations of these variables. Its general objective are (i) data reduction and (ii) interpretations (Johnson & Wichem, 2014). Principle component analysis can be applied on six literacy parameter and reduces in few principle components summarizing the data without any loss of information. The educational development index is worked out by using the following formulae (Jadhav *et al.,* 2001).

$$\text{Index} = \frac{\sum_{i=1}^{6} V_i \sum_{i=1}^{6} F_{ij} E_j}{\sum_{i=1}^{6} F_{ij} E_j}$$

Where,

F_{ij} = Factor loading (variable i, principle components

E_j = Eigen value (principle component j)

V_i = Variable i

i, j = 1,2,3,….,6.

To build up composite variable rank, the state ranks have been worked out for each sub-parameter separately. These ranks for each the sub-parameters then have been combined together to arrive at the composite variable rank (Jadhav *et al.,* 2001).

Attempt has been made to use Growth Index to study the growth of the variable over a period of time and is given by the equation (Jadhav *et al.,* 2001; census.gov).

$$\text{Growth Index} = \frac{\frac{\left(V_{\text{Present}} - V_{\text{Past}}\right)}{V_{\text{Past}}} * 100}{N}$$

Where,

V_{Present} = present value

V_{Past} = past value

N = No. of year = 10

RESULTS AND DISCUSSION

The Eigen values of principle components analysis

is explain the amount of variation extracted by principle component. The six literacy parameter selected such as general male, female (GML & GFL), schedule castes male, female (SCM & SCF) and scheduled tribe male, female literacy (STM & STFL) for studying literacy levels in major states of India.

Table 1: Eigen value

Principal Component	Eigen Values	Total variance Explained	Cumulative Variance Explained
First	4.06	0.68	0.68
Second	1.8	0.30	0.98

Table 2: Factor loading for literacy variable

Literacy	Factor Loading	
	First Principal Component	Second Principal Component
GML	**0.97**	0.15
GFL	**0.97**	0.14
SCML	**0.95**	0.26
SCFL	0.95	0.24
STML	0.43	**0.90**
STFL	0.41	**0.91**

The ST male and female literacy exhibit a low degree of correlation among all the parameters and other parameters contribute high degree of correlation. The Communalities observed that ST male and female literacy have very high variations. From the total variance table, two components of variation have Eigen values greater than one and explain 68% and 30% respectively. From the rotated component matrix, 2 components extracted are (1) General male, female and SC male, female literate are strongly associated with factor 1 and (2) ST male, female literates are strongly associated with factor 2. From principle component analysis, we observed that ST male and female population have low literacy as compare to other in India

The Principle Component Analysis (PCA) has reduced six literacy variables into two principle components. The Eigen values of each transformed variables explains the variability in original variables. The formulae applied for estimating index with the help of Principal Component analysis is as follows:

$$\text{Index} = \frac{\sum_{i=1}^{6} V_i \sum_{i=1}^{6} F_{ij} E_j}{\sum_{i=1}^{6} F_{ij} E_j}$$

Table 3: EDI for literacy parameter

State	Literacy Rate							
	GML	GFL	SCML	SCFL	STML	STFL	Index	Rank
Andhra Pradesh	68.96	55.53	62.20	48.51	50.50	35.04	0.547	19
Assam	65.57	56.18	72.21	61.01	67.65	56.04	0.642	11
Bihar	60.70	44.35	46.01	30.21	49.91	32.79	0.450	24
Chhattisgarh	73.77	57.63	68.85	50.73	58.85	41.38	0.598	17
Goa	83.95	77.96	80.35	69.71	78.11	64.66	0.773	3
Gujarat	76.94	63.93	77.04	61.54	60.16	44.85	0.655	10
Himachal Pradesh	80.98	68.12	75.19	62.69	72.64	56.64	0.708	6
Jammu & Kashmir	66.21	49.41	67.76	52.56	48.21	31.72	0.538	20
Jharkhand	69.30	51.92	54.85	36.00	56.44	38.47	0.523	22
Karnataka	75.56	64.00	64.30	49.34	61.63	46.08	0.615	15
Kerala	85.95	83.91	83.48	77.41	71.29	63.44	0.793	1
Madhya Pradesh	73.43	57.25	64.79	46.24	48.38	33.94	0.554	18
Maharashtra	79.58	69.88	76.35	63.29	63.17	48.69	0.683	7
Manipur	76.33	62.92	72.27	60.20	66.77	59.16	0.676	8
Meghalaya	67.23	58.09	65.01	52.72	60.23	59.23	0.616	14
Mizoram	80.75	70.74	86.62	76.64	78.82	75.85	0.790	2
Odisha	78.41	65.98	68.51	51.12	53.35	34.82	0.602	16
Rajasthan	70.25	48.71	61.37	37.33	55.00	30.52	0.517	23
Sikkim	79.07	68.30	72.58	63.00	75.98	66.38	0.722	5
Tamil Nadu	79.39	68.35	71.81	58.58	53.46	40.88	0.636	12
Tripura	83.72	78.56	81.83	75.89	73.26	60.98	0.771	4
Uttar Pradesh	66.84	50.57	59.78	40.60	54.82	35.80	0.526	21
Uttarakhand	76.19	62.69	71.35	54.46	73.49	56.46	0.671	9
West Bengal	74.69	66.90	68.05	53.91	59.08	41.51	0.621	13

Table 4: Composite index for literacy parameter

Name of State	General		SC		ST		Composite index		
	M	F	M	F	M	F	M	F	Total
Andhra Pradesh	19	19	20	19	21	19	18	17	18
Assam	23	18	10	9	8	10	19	15	15
Bihar	24	24	24	24	22	22	24	24	24
Chhattisgarh	15	16	13	17	15	15	15	18	16
Goa	2	3	4	4	2	3	2	2	2
Gujarat	10	12	5	8	13	13	10	12	10
Himachal Pradesh	4	8	7	7	6	8	4	5	5
Jammu & Kashmir	22	22	16	15	24	23	22	21	21
Jharkhand	18	20	23	23	16	17	21	22	23
Karnataka	13	11	19	18	11	12	11	13	13
Kerala	1	1	2	1	7	4	1	1	1
Madhya Pradesh	16	17	18	20	23	21	16	19	19
Maharashtra	6	5	6	5	10	11	7	7	7
Manipur	11	13	9	10	9	7	12	10	12
Meghalaya	20	15	17	14	13	6	23	14	17
Mizoram	5	7	1	2	1	1	5	3	3
Orissa	6	10	14	16	20	20	14	16	14
Rajasthan	17	23	21	22	17	24	17	23	22
Sikkim	8	7	8	6	3	2	6	6	6
Tamil Nadu	7	6	11	11	19	16	8	8	8
Tripura	3	2	3	3	5	5	3	4	4
Uttar Pradesh	21	21	22	21	18	18	20	20	20
Uttarakhand	12	14	12	12	4	9	9	11	9
West Bengal	14	9	15	13	14	14	13	9	11

Table 3 presents Educational development index for three different categories of all states of India and the state ranks derived by principle component analysis. All states literacy levels have been ranked in the descending order. Kerala has the highest rank for EDI and Bihar is last among all states.

A composite index is a grouping of equities, indexes or other factors combined in a standardized way, providing a useful statistical measure of overall market or sector performance over time, and it is also known simply as a composite [12]. The composite literacy index of all states of India are ranked in descending order and presented in Table 4. It has been observed from Table 4 that the composite variable ranking arranges in descending order. The Kerala state leading highest rank in General male, female categories and ST male, female composite variable rank higher in Mizoram state of India.

The growth index will provide estimate of the growth in literacy during the period 2001 to 2011. The index has been developed separately for General male, female, Schedule caste male, female, Schedule Tribes male, female literacy population.

There is observing faster growth in literacy for Bihar and Jharkhand during 2001-2011. Bihar got 1st rank for general category but not for Schedule castes and Scheduled Tribes male and female literacy rate. We observed higher growth in case of SC and ST literacy in Mizoram and Goa respectively. In overall discussion Jharkhand state is 2nd rank during this period.

Table 5: State wise literacy growth of India

Name of State	General		SC		ST		Total		Total
	M	F	M	F	M	F	M	F	
Andhra Pradesh	18	18	20	19	13	12	22	19	21
Assam	7	6	13	15	21	23	12	12	12
Bihar	1	1	2	2	3	3	1	1	1
Chhattisgarh	6	10	7	11	23	22	10	13	11
Goa	24	24	23	22	1	1	23	23	23
Gujarat	5	7	22	20	17	16	8	14	10
Himachal Pradesh	20	22	21	21	5	9	21	22	22
Jammu & Kashmir	3	5	12	16	7	7	5	4	5
Jharkhand	4	4	5	3	8	6	3	2	2
Karnataka	12	14	8	10	14	15	15	16	16
Kerala	23	23	24	24	9	19	24	24	24
Madhya Pradesh	11	12	16	13	19	13	14	11	13
Maharashtra	19	20	9	12	20	18	20	18	20
Manipur	13	11	4	6	6	14	6	6	6
Meghalaya	9	9	3	4	10	20	2	5	3
Mizoram	10	2	1	1	24	24	17	21	18
Odisha	17	15	17	7	18	5	16	10	14
Rajasthan	9	8	11	8	16	10	9	7	9
Sikkim	22	21	19	23	4	4	7	8	7
Tamil Nadu	15	19	14	17	11	17	19	20	19
Tripura	14	17	15	18	12	11	11	9	8
Uttar Pradesh	2	3	6	5	2	2	4	3	4
Uttarakhand	10	13	10	9	22	21	13	15	15
West Bengal	16	16	18	14	15	8	18	17	17

Table 6: Comparisons of three ranking method

States	Composite Variable Rank	Principal Component Rank	Growth Rank
Andhra Pradesh	18	19	21
Assam	15	11	12
Bihar	24	24	1
Chhattisgarh	16	17	11
Goa	2	3	23
Gujarat	10	10	10
Himachal Pradesh	5	6	22
Jammu & Kashmir	21	20	5
Jharkhand	23	22	2
Karnataka	13	15	16
Kerala	1	1	24
Madhya Pradesh	19	18	13
Maharashtra	7	7	20
Manipur	12	8	6
Meghalaya	17	14	3
Mizoram	3	2	18
Odisha	14	16	14
Rajasthan	22	23	9
Sikkim	6	5	7
Tamil Nadu	8	12	19
Tripura	4	4	8
Uttar Pradesh	20	21	4
Uttarakhand	9	9	15
West Bengal	11	13	17

Table 6 shows the comparative scenario of educational development ranks which is worked out on the basis of three different techniques. All the methods show the Kerala is the leading higher rank in literacy except in growth index. Bihar is higher rank as compared to the other state in case of growth ranking. The literacy rate is very low in Bihar than growth at decadal large from the literacy index.

CONCLUSION

The paper presents the empirical analysis of educational development index of all state of India. The deeply discussion concentrate on the result of educational development index on the basis of three techniques like principle component analysis, composite variable index, growth index. In principle component analysis create two communalities shows the ST categories secure large variation in literacy rate as compare to other category. Kerala state is leading higher rank in principle component and composite variable rank expecting the growth index. Bihar state leads the highest growth in 2001 to 2011 period. In Bihar state, literacy rate is very low; this state has served social problems that large effect on education schemes.

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