Determinants of Educational Status in India –Principal Component Analysis based on Aishe Data

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Abstract: The states in India are diverse in nature. The scenario of higher education across the states can be compared based on certain parameters like number of Ph D enrolment, gender ratio, number of post-graduate enrolment, college population index, student teacher ratio, etc.. this communication has used principal component analysis method to have determinants of higher education for comparing the states. The data of AISHE for the period 2012-13 to 2017-18 have been taken.
Keywords: principal component analysis, college population index, gender ratio, student teacher ratio, AISHE

I. INTRODUCTION

The problem of disparity in development is a major concern. The disparity means inequality, imbalances. Disparity is state of being unequal. In general, regional disparity means failure of a region to exploit development potential of its initial resources endowments and resources advantages in relation to another region, comprising factors other than the natural. The attributes of development can be achieved only through structural changes of economy, socio-cultural change in attitude and motivation of the people. Education is the vital instrument for such changes. The successful national planning and development policies for ensuring balanced development is possible only when socio-cultural aspect like education is looked into proper perspective. The word 'Education' has a very wide connotation and it is very difficult to give its precise definition. According to Aristotle education is "the creation of a sound mind in a sound body" (Ashraf, et al., 2008). The concept of education for formal schooling has got replaced by a broader concept, including wide variety of activities which directly or indirectly influence the growth and development of an individual and the society (Surendra and Ashraf, 2011). Education does not merely mean the acquisition of knowledge or experience but it means the development of habits, attitudes and skills that help a man to lead a full and worthwhile life. Education is a light for life. Education improves knowledge and skill and helps people to pull them out of poverty. education is the very much needed asset than other asset. Educational attainment is an important indicator to monitor the development of a nation. Improving education, literacy, and knowledge not only improves wellbeing but it also leads to better life outcomes. "Education is one of the most powerful instruments societies have for reducing deprivation and vulnerability: it helps lift earning potential, expands mobility, promotes the health of parents and children, reduces fertility and child mortality, and affords the disadvantaged a voice in society and the political system". Development is a multi-dimensional phenomenon. Some of its major dimensions include: the level of economic growth, level of education, level of health services, degree of modernization, status of women, level of nutrition, quality of housing, distribution of goods and services, and access to communication. In India, the progress of socio-economic development among major states is not uniform.

II. DATA

In the present study, 9 variables have been selected to show spatial variation in levels of education of the states in India. The period of reference is 2011. The study is based on the following variables:

1. Average enrolment per HEI (X_1)
2. Number of Ph D student enrolment (X_2)
3. Number of Post-Graduate enrolment (X_3)
4. Gender Ratio (X_4)
5. Total enrolment(X_5)
6. Gross Enrolment Ratio (X_6)
7. Gender Parity Index (X_7)

8.   Student Teacher Ratio (X_8)
9.   College population index/Number of college per 100000 population in the age group 18-23 years (X_9)

The data has been collected from the Final Report of All India Survey on Higher Education (AISHE) for 2017-18. The variables have been observed for the years 2012-13 to 2017-18 for 23 states in India - Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal.

III. ANALYSIS

The methodology adopted here is 'Principal Component Analysis (PCA)'. Through this technique factor loading and factor score have been calculated. Finally, the structural and regional pattern have been analysed with the general notions based on theoretical knowledge and observational ideas (Bhuiyan and Banerjee, 1991). Computation for this analysis was carried using Statistica software which gives a principal component solution. The model for the principal component analysis used in the study involves the following steps:

□ The Eigen vectors of the matrix have been worked out (Table-1)
□ Factor Loading has been done (Table-2)

The same calculations have been done for all the years. Before working out scores oftwo factors, it is important to see that whether they can be meaningfully interpreted and which are the variables that help in deriving new component.

Table-1 : showing eigen values and variability percentages for the years 2012-13 to 2017-18

2012-13				2015-16			
Factor	Eigen value	Percentage Total Variance	Cumulative Percentage Variance	Factor	Eigen value	Percentage Total Variance	Cumulative Percentage Variance
1	3.6875	40.9722	40.9722	1	3.7418	41.5761	41.5761
2	2.5280	28.0887	69.0608	2	2.8246	31.3842	72.9603
3	1.5402	17.1138	86.1746	3	1.3437	14.9299	87.8902
4	0.5912	06.5685	92.7431	4	0.4955	05.5051	93.3953
5	0.2760	03.0671	95.8102	5	0.2559	02.8436	96.2389
2013-14				2016-17			
1	3.4776	38.6402	38.6402	1	3.7313	41.4594	41.4594
2	2.6664	29.6264	68.2666	2	2.7422	30.4691	71.9285
3	1.5909	17.6764	85.9430	3	1.3457	14.9517	86.8802
4	0.6399	07.1100	93.0530	4	0.5178	05.7537	92.6340
5	0.3265	03.6273	96.6803	5	0.2915	03.2386	95.8725
2014-15				2017-18			
1	3.7341	41.4899	41.4899	1	3.7223	37.2227	37.2227
2	2.5029	27.8095	69.2994	2	2.5722	25.7220	62.9447
3	1.2827	14.2520	83.5515	3	1.4816	14.8162	77.7608
4	0.7070	07.8557	91.4071	4	0.9878	09.8777	87.6385
5	0.3647	04.0523	95.4595	5	0.6098	06.0984	93.7369

In 2012-13, among the 9 variables, total variance is 69.06 percent in first 2 factors. First component explained 40.97 percent, followed by 28.09 percent (second component). Factor loading of first component shows that it has significant correlation with number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), total student enrolment in HEI(X_5), gross enrolment ratio(X_6) and Number of college per 100000 populations in the age group 18-23 years (X_9in Table-2). Similarly, the high correlation is associated with the second component those are related to number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), gender ratio(X_4), total student enrolment in HEI(X_5), gross enrolment ratio(X_6), student teacher ratio (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9in Table-2)respectively.

In 2013-14, among the 9 variables, total variance is 68.27 percent in first 2 factors. First component explained 38.64 percent, followed by 29.62 percent (second component). Factor loading of first component shows that it has significant correlation with number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), total student enrolment in HEI(X_5), gross enrolment ratio(X_6), student teacher ratio (X_8) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2). Similarly, the high correlation is associated with the second component those are related to number of post-graduate enrolment(X_3),

gender ratio(X_4), gross enrolment ratio(X_6), gender parity index (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2) respectively.

In 2014-15, among the 9 variables, total variance is 69.29 percent in first 2 factors. First component explained 41.49 percent, followed by 27.81 percent (second component). Factor loading of first component shows that it has significant correlation with average enrolment per HEI (X_1), number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), total student enrolment in HEI(X_5), gross enrolment ratio(X_6)and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2). Similarly, the high correlation is associated with the second component those are related to average enrolment per HEI (X_1), number of Ph D enrolment(X_2), gender ratio(X_4), gross enrolment ratio(X_6), student teacher ratio (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2) respectively.

In 2015-16, among the 9 variables, total variance is 72.46 percent in first 2 factors. First component explained 41.57 percent, followed by 31.38 percent (second component). Factor loading of first component shows that it has significant correlation with number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), gender ratio(X_4),total student enrolment in HEI(X_5), gross enrolment ratio(X_6), student teacher ratio (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2). Similarly, the high correlation is associated with the second component those are related to average enrolment per HEI (X_1),gender ratio(X_4), gender parity index (X_7) and student teacher ratio (X_8in Table-2) respectively.

In 2016-17, among the 9 variables, total variance is 71.93 percent in first 2 factors. First component explained 41.46 percent, followed by 30.47 percent (second component). Factor loading of first component shows that it has significant correlation with gender ratio(X_4), gross enrolment ratio(X_6), gender parity index (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2). Similarly, the high correlation is associated with the second component those are related to average enrolment per HEI (X_1), gender ratio(X_4), gender parity index (X_7) and student teacher ratio (X_8in Table-2) respectively.

In 2017-18, among the 9 variables, total variance is 62.94 percent in first 2 factors. First component explained 37.22 percent, followed by 25.72 percent (second component). Factor loading of first component shows that it has significant correlation with number of post-graduate enrolment(X_3), gender ratio(X_4), total student enrolment in HEI(X_5), gross enrolment ratio(X_6), gender parity index (X_7) and Number of college per 100000 populations in the age group 18-23 years (X_9 in Table-2). Similarly, the high correlation is associated with the second component those are related to number of Ph D enrolment(X_2), number of post-graduate enrolment(X_3), total student enrolment in HEI(X_5), gross enrolment ratio(X_6) and student teacher ratio (X_8 in Table-2) respectively.

For all the years, number of college per 100000 populations in the age group 18-23 years, number of post-graduate enrolment and total student enrolment in HEIs are most deterministic components for first factor. Similarly, for second factor, gender ratio and gender parity index are deterministic components.

Table-2 : showing factor loading (Varimax normalized) of first 2 factors for the years 2012-13 to 2017-18

2012-13			2015-16		
Variable	Factor 1	Factor 2	Variable	Factor 1	Factor 2
X_1	-0.0262	-0.9845	X_1	-0.9792	0.0091
X_2	0.6288	0.0166	X_2	0.0324	-0.8105
X_3	0.9288	0.1179	X_3	0.1296	-0.9573
X_4	-0.1552	0.0209	X_4	0.1800	0.1126
X_5	0.9607	0.0398	X_5	0.0682	-0.9638
X_6	0.3412	0.2373	X_6	0.2018	-0.3772
X_7	-0.0598	0.1471	X_7	0.1678	0.1550
X_8	-0.0217	-0.9173	X_8	-0.8364	0.1039
X_9	0.2193	0.7998	X_9	0.8406	-0.1983
2013-14			2016-17		
X_1	-0.0662	-0.9607	X_1	-0.1118	0.0645
X_2	0.7378	-0.0155	X_2	-0.0028	-0.7003
X_3	0.9397	0.1177	X_3	-0.1566	-0.9514
X_4	-0.0686	0.1120	X_4	0.9558	0.1048
X_5	0.9696	-0.0158	X_5	-0.1418	-0.9697
X_6	0.3626	0.2266	X_6	0.3456	-0.2966
X_7	-0.1527	0.0769	X_7	0.9143	0.1885
X_8	0.1053	-0.8981	X_8	-0.2030	0.0763
X_9	0.2265	0.7559	X_9	0.1971	-0.1745
2014-15			2017-18		

X_1	0.1367	0.0554	X_1	-0.9617	-0.0636
X_2	0.7795	0.0409	X_2	-0.0765	0.3108
X_3	0.9412	-0.1258	X_3	0.1397	0.9362
X_4	-0.0215	0.9737	X_4	0.1594	-0.0220
X_5	0.9583	-0.1099	X_5	0.1057	0.9186
X_6	0.3714	0.2883	X_6	0.2721	0.2083
X_7	-0.1803	0.9218	X_7	0.2375	-0.2089
X_8	-0.0783	-0.1597	X_8	-0.8302	0.0079
X_9	0.1477	0.2245	X_9	0.8713	0.2182

Table 3 Structure of Two Leading Components for Disparity

In 2012-13,**Component I: Enrolment Status**
40.97% Variance;0.6288% of number of Ph D enrolment, 0.9288% of number of post-graduate enrolment and 0.9607% of total enrolment in HEIs
Component II: Quality/Indicator
28.09% Variance;-0.9845average students enrolled in HEIs and-0.9173 student teacher ratio in HEIs

In 2013-14,**Component I: Enrolment Status**
38.64% Variance;0.7378% of number of Ph D enrolment, 0.9397% of number of post-graduate enrolment and 0.9696% of total enrolment in HEIs
Component II: Quality/Indicator
29.62% Variance;-0.9607 average students enrolled in HEIs, -0.8981 student teacher ratio in HEIs and 0.7559 college population index

In 2014-15,**Component I: Enrolment Status**
41.49% Variance; 0.7795% of number of Ph D enrolment, 0.9412% of number of post-graduate enrolment and 0.9383% of total enrolment in HEIs
Component II: Gender Status
27.81% Variance; 0.737 gender ratio and 0.9218 gender parity index

In 2015-16,**Component I: Quality/Indicator**
41.57% Variance; -0.9792% average enrolment per HEI, -0.8364% student teacher ratio and 0.8306% college population index
Component II: Enrolment Status
31.38% Variance; -0.8105%number of Ph D students, -0.9573%of number of post-graduate enrolment and -0.9638% of total enrolment in HEIs

In 2016-17,**Component I: Gender Status**
41.45% Variance; 0.9558% gender ratio and 0.9143% gender parity index
Component II: Enrolment Status
30.47% Variance; -0.9697% of number of post-graduate enrolment and -0.9514% of total enrolment in HEIs

In 2017-18,**Component I: Quality/Indicator**
37.22% Variance; -0.8302% student teacher ratio and 0.8713% college population index
Component II: Enrolment Status
25.72% Variance; 0.9362% of number of post-graduate enrolment and 0.9186% of total enrolment in HEIs

IV. CONCLUSION

There is substantial evidence that education can reduce poverty. This connection betweeneducation and poverty work through three mechanisms firstly, more educated people earn more;secondly, more education improves economic growth and thereby economic opportunities andincomes; and thirdly, education brings social benefits that improves economic development.Poverty reduction and education development are the prerequisite for inclusive growth which isbeing emphasized by the Planning Commission.The enrolment status as well as few quality indicators plays role as determinants in the disparity among the states. The enrolment status is mainly driven by the number of post-graduate enrolment, number of Ph D students, total enrolment in HEIs. The variables like student teacher ratio, college population index, gender parity index and gender ratio are the determinants in showing disparity among states. Micro-level study like district or block level may indicate the actual disparity status more vividly.

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