

Misclassification of the States based on AISHE data of last 7 years

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Abstract: *There are development indicators for elementary education as developed by NEUPA. There is no such for higher education in relation to India. Based on AISHE database, a number of factors has been taken as indicators for higher education development. Using cluster analysis, an attempt has been made to classify the states on India into different homogeneous clusters. Thus, a ranking of the states of India has also been made considering all seven years data of AISHE.*

Keywords: *Development Indicators for Higher Education, Classification, Cluster Analysis, Ranking*

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I. INTRODUCTION

The vision of RUSA (Rashtriya Uchchar Shiksha Abhiyan) are higher levels of access, equity and excellence in the State higher education system with greater efficiency, transparency, accountability and responsiveness. One of the components is ‘expand the institutional base by creating additional capacity in existing institutions and establishing new institutions in un-served and under-served areas by way of up-gradation and consolidation’.

The others are also to ‘correct regional imbalances in access to higher education’ and ‘states would be free to mobilize private sector participation through innovative means, limited to a ceiling of 50% of the State share’. It has also been stated that the improvement in equity in higher education by providing adequate opportunities of higher education to SC/STs and socially and educationally backward classes may be done by new colleges, new professional colleges, vocationalisation of higher education, etc.

Our vision is to transform lives through education, recognizing the important role of education as a main driver of development and in achieving the other proposed development indices. It is an urgency to a single, renewed education agenda that is holistic, ambitious and inspirational, leaving no one behind. It is transformative and universal, attends to the ‘unfinished business’ of the development, and addresses global and national education challenges. It is inspired by a humanistic vision of education and development based on human rights and dignity; social justice; inclusion; protection; cultural, linguistic and ethnic diversity; and shared responsibility and accountability. It is accepted as null that education is a key to achieve full employment and poverty eradication. It will commit to address all forms of exclusion and marginalization, disparities and inequalities in access, participation and learning outcomes. It is also committed to support gender-sensitive policies, planning and learning environments; mainstreaming gender issues in teacher training and curricula; and eliminating gender based discrimination and violence towards quality education and to improving learning outcomes. It is also committed to strengthen science, technology and innovation. Information and communication technologies (ICTs) must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision. It is recommended to increase public spending on education. Based on draft UNESCO report 2015, a set of development indicators have been considered to gauge the development in higher education of the states in India (Ghara 2016). Shortage of skilled teachers remains the biggest challenge for the education sector across the world, which is expected to pose a serious threat particularly for private operators to maintain the quality of education provided by them. The enrolment rate in the higher education segment remains low in the other countries as compared to the developed nations, reflecting a mismatch between skills taught to graduates and requirements of the labor market. This is likely to have an effect on the unemployment rate of the region.

In literature, the indicators used are – (i) percentage of population in the age group to the total population, (ii) apparent intake rate, (iii) net intake rate, (iv) gross enrolment ratio, (v) net enrolment ratio, (vi) age-specific enrolment ratio, (vii) percentage of private enrolment, (viii) enrolment by gender and social group/s, (ix) percentage of girls/female enrolment, (x) percentage of teachers by gender and social group, (xi) student class-room ratio, (xii) percentage of institutions with/without toilet, (xiii) percentage of institutions with furniture, (xiv) percentage of institutions with medium as mother tongue, (xv) percentage of institutions with/without library facilities, (xvi) percentage of trained teachers, (xvii) pupil teacher ratio, (xviii) expenditure,

(xix) transition rate, (xx) percentage of repeaters, (xxi) repetition rate, (xxii) survival rate by grade, (xxiii) coefficient of efficiency, (xxiv) percentage of under-aged and over-aged students, (xxv) percentage of teachers in private institutions, etc..(Ghara 2016). To portray the status of higher education in the country, Ministry of Human Resource Development has endeavoured to conduct an annual web-based effort All India Survey on Higher Education (AISHE) since 2010-11. Indicators of educational development such as Institution Density, Gross Enrolment Ratio, Pupil-teacher ratio, Gender Parity Index, Per Student Expenditure will also be calculated from the data collected through AISHE. Based on AISHE database, in this paper, it is being tried to quantify the development in higher education by framing an indicator and attempt is being made to rank the States of India. Cluster Analysis has been used to choose a smaller set of variables objectively. Based on the variables selected, a classification of the states on India has been made (using Minitab Software trial). Thus ranking of the States has been made.

DATA

AISHE has been taken as main source of data. 30 states have been considered for a period of 7 years 2012-13, 2013-14, 2014-15, 2015-16, 2016-17, 2017-18, 2018-19. The states considered here are Andhra Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Puducherry, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand and West Bengal. The following variables are being used for gauging the higher education – (i) the number of institutions (university-college-standalone)(X1); (ii) Total enrolment (X2); (iii) total number of teaching staff in position(X3); (iv) total number of filled up non-teaching staff(X4); (v) number of institutes having/providing or allowing educational loan to student(X5); (vi) number of library in the campus(X6); (vii) number of laboratory in the institutes(X7); (viii) amount (‘000) earned by donations, fees, interest & sales of the institutes(X8); (ix) amount(‘000) made as expenditure by salary of the staff, construction/physical assets & building-maintenance of library-laboratory(X9); (x) amount(‘000) allowed as benefits to students by scholarships/ freeships(X10).

ANALYSIS

X_{ij} is the value of X_i (ith variable) corresponding to jth state at t^{th} time period; $i=1(1)10, j=1(1)30$ and $t=1(1)7$. It is to note that the variables are in different scales and units. To make variables comparable, a standardised transformation is used as follows –

For fixed t and j , $Z_{ij} = (X_{ij} - \text{minimum value}) / (\text{Maximum value} - \text{minimum value})$, $i=1(1)10, j=1(1)30$ and $t=1(1)7$

For fixed t , PCA is used on Z_{ij} 's to determine weights for each variables and each state. The 1st eigen vector are being used as weights for variables. The total score (Total Raw Score) may be weighted sum of Z-values for selected the variables. i.e. for fixed j and t .

For fixed t , the jth State index $S_{ij} = \sum_{i=1}^p \{W_{ij}Z_{ij}\}$

Where Z_{ij} = the transformed score for ith variable and jth State

W_{ij} = the weight for ith variable as contribution corresponding to (F1) (obtained using PCA) and jth State; $i = 1, 2, \dots, 10(p)$, $j = j$ th State – Andhra Pradesh,, West Bengal and $t = t$ -th time period – 2012-13, 2013-14,, 2018-19.

For fixed t , R_{ij} is the rank among S_{ij} (arranged among j 's), $j=1(1)30$ and $t=1(1)7$.

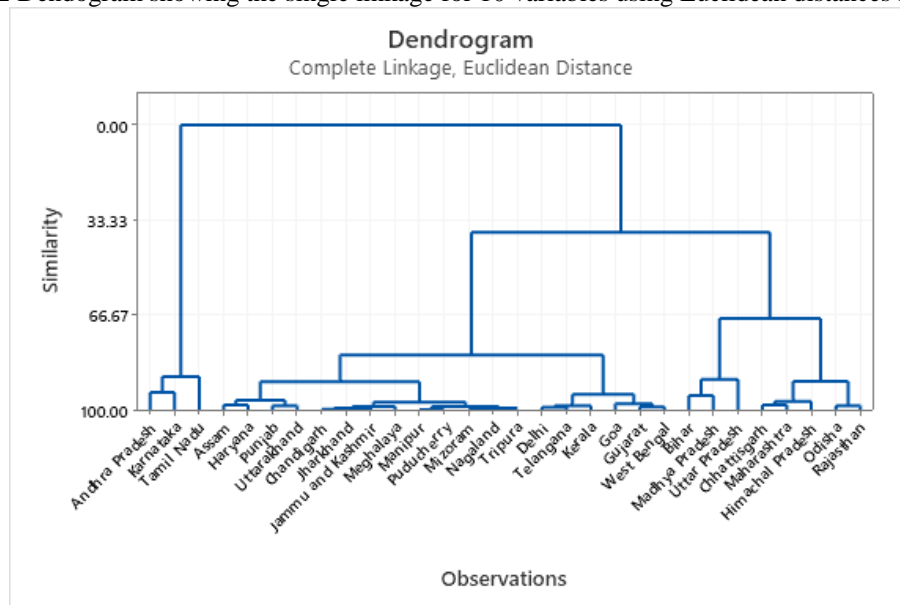
Table – 1.1 showing Ranks for 7 time periods for all 30 states

| STATE(j) | R _{1j} | R _{2j} | R _{3j} | R _{4j} | R _{5j} | R _{6j} | R _{7j} |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Andhra Pradesh | 1 | 14 | 11 | 3 | 2 | 12 | 1 |
| Assam | 21 | 9 | 10 | 20 | 19 | 21 | 11 |
| Bihar | 4 | 18 | 8 | 12 | 10 | 9 | 8 |
| Chandigarh | 24 | 25 | 28 | 25 | 25 | 25 | 16 |
| Chhattisgarh | 8 | 20 | 18 | 22 | 22 | 20 | 18 |
| Delhi | 16 | 17 | 19 | 18 | 11 | 19 | 9 |
| Goa | 12 | 27 | 26 | 28 | 28 | 28 | 24 |
| Gujarat | 13 | 15 | 12 | 10 | 17 | 8 | 13 |
| Haryana | 20 | 16 | 13 | 16 | 14 | 10 | 4 |
| Himachal Pradesh | 9 | 5 | 22 | 11 | 7 | 1 | 20 |
| Jammu and Kashmir | 25 | 12 | 24 | 23 | 15 | 22 | 22 |
| Jharkhand | 23 | 24 | 23 | 21 | 13 | 17 | 19 |
| Karnataka | 2 | 2 | 1 | 2 | 5 | 5 | 7 |
| Kerala | 17 | 19 | 17 | 17 | 20 | 16 | 21 |
| Madhya Pradesh | 5 | 10 | 9 | 4 | 6 | 11 | 5 |
| Maharashtra | 7 | 6 | 5 | 8 | 4 | 3 | 17 |
| Manipur | 26 | 22 | 27 | 27 | 27 | 26 | 25 |
| Meghalaya | 22 | 23 | 21 | 15 | 24 | 24 | 27 |

| | | | | | | | |
|---------------|----|----|----|----|----|----|----|
| Mizoram | 29 | 29 | 30 | 26 | 21 | 23 | 30 |
| Nagaland | 30 | 30 | 25 | 30 | 30 | 30 | 29 |
| Odisha | 11 | 13 | 14 | 7 | 9 | 18 | 10 |
| Puducherry | 27 | 26 | 20 | 24 | 26 | 27 | 26 |
| Punjab | 18 | 1 | 4 | 5 | 16 | 13 | 14 |
| Rajasthan | 10 | 7 | 7 | 9 | 3 | 4 | 2 |
| Tamil Nadu | 3 | 3 | 3 | 1 | 8 | 2 | 3 |
| Telangana | 15 | 11 | 6 | 6 | 18 | 14 | 23 |
| Tripura | 28 | 28 | 29 | 29 | 29 | 29 | 28 |
| Uttar Pradesh | 6 | 4 | 2 | 13 | 1 | 6 | 12 |
| Uttarakhand | 19 | 21 | 15 | 19 | 23 | 15 | 6 |
| West Bengal | 14 | 8 | 16 | 14 | 12 | 7 | 15 |

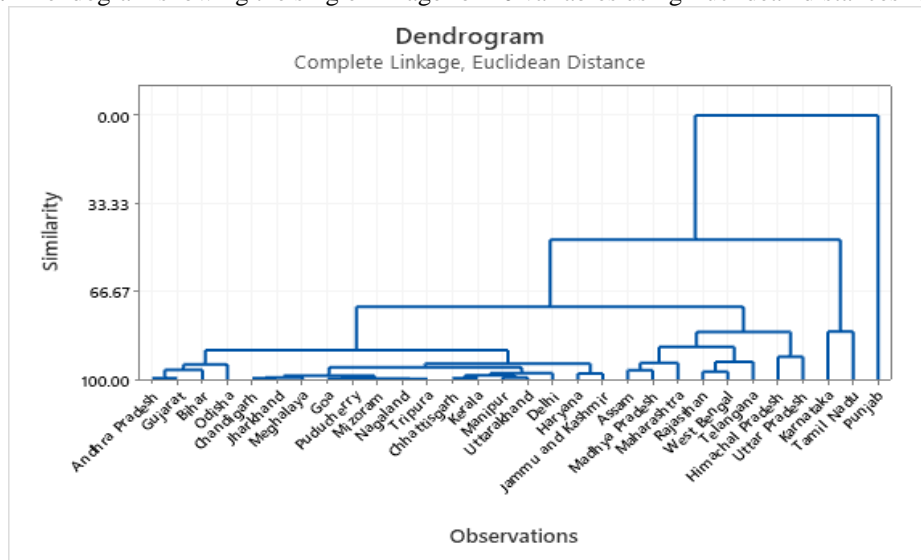
The correlation coefficient between R_{ij} and R_{t^*j} are 0.67, 0.82, 0.85, 0.80, 0.85 and 0.67; $t=1(1)6$ and $t^*=2(1)7$. It implies that scores are positively highly related but there may a different pattern appearing from 2017-18 and 2018-19. Also, Total Rank Score for all the states over 7 years has been calculated and ranked the states. It appears that Tamil Nadu, Karnataka, Rajasthan are the top 3 states. To study any significant clustering among the states by the group of 10 variables considered, cluster analysis has been utilised.

Figure 1.1 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2012-13



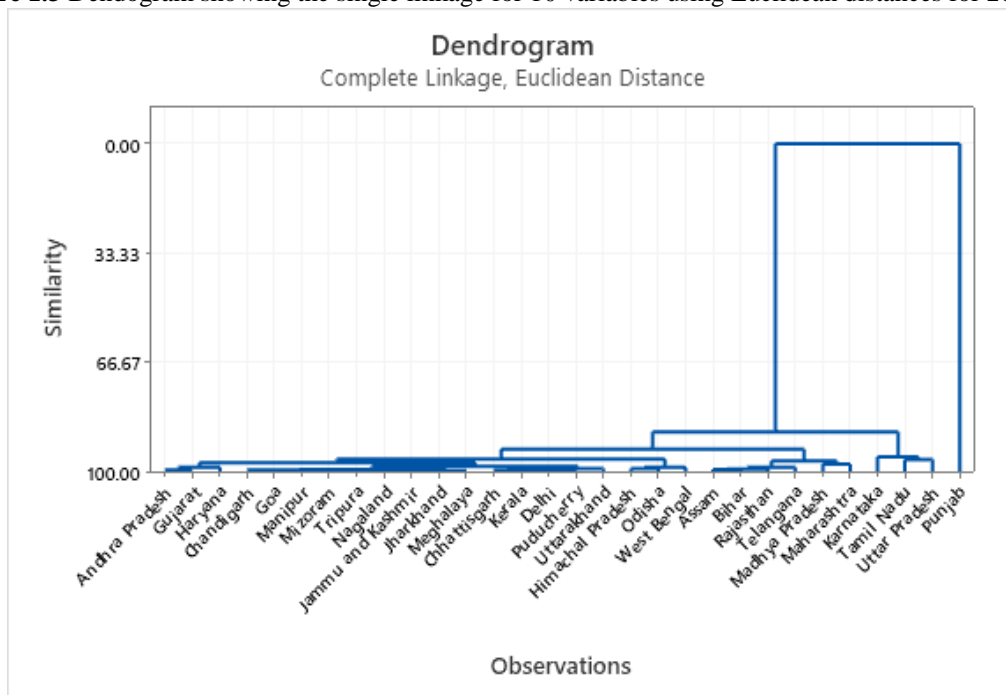
It is being observed that Andhra Pradesh, Karnataka & Tamil Nadu in a cluster and other states in another cluster. On the second linkage, Andhra Pradesh, Karnataka, Tamil Nadu in a cluster, Bihar, Padhya Pradesh, Uttar Pradesh, Chhattisgarh, Maharastra, Himachal Pradesh, Odisha, Rajasthan in another cluster and rest states in other cluster. So on..

Figure 1.2 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2013-14



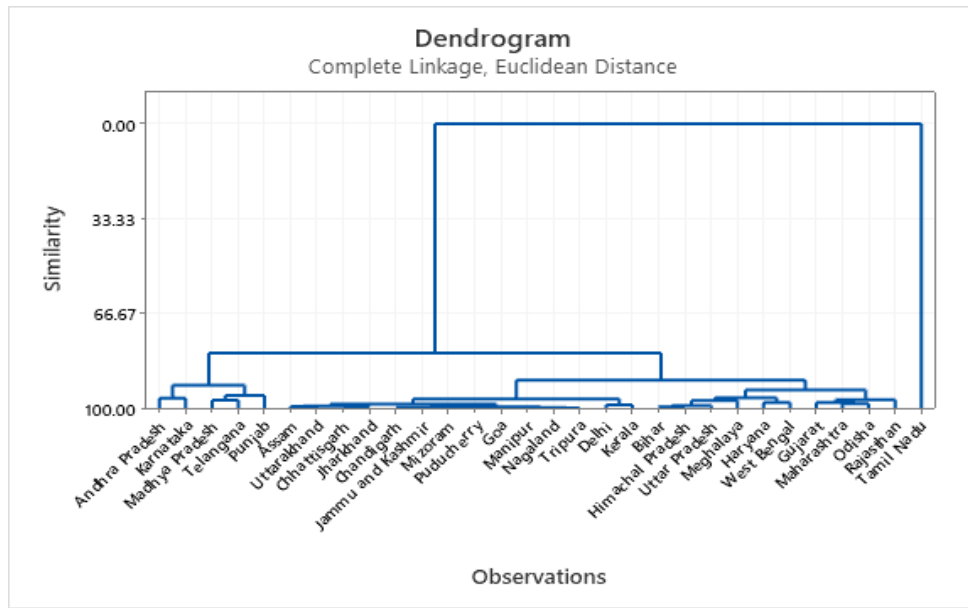
It is being observed that only Punjab in a cluster and other states in another cluster. On the second linkage, Punjab in a cluster, Karnataka & Tamil Nadu in another cluster and rest states in other cluster. So on..

Figure 1.3 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2014-15



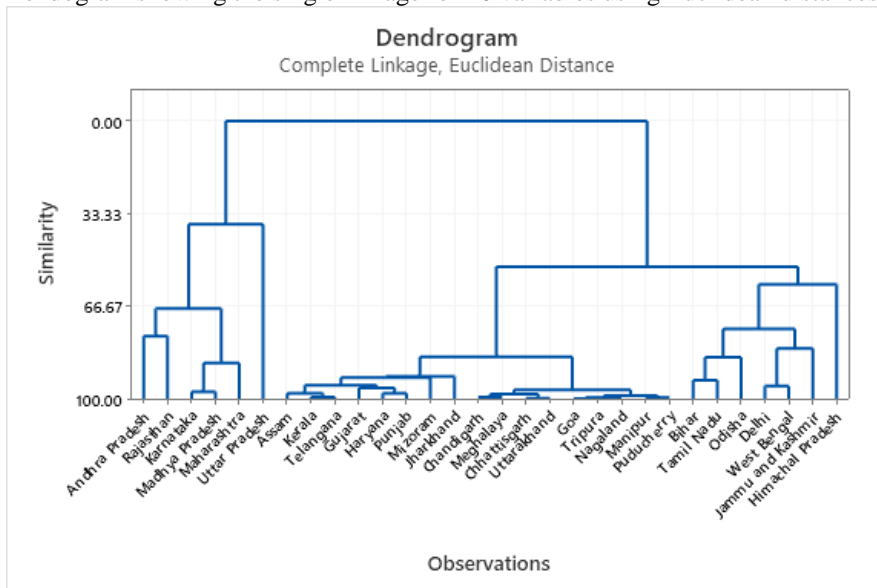
It is being observed that only Punjab in a cluster and other states in another cluster. On the second linkage, Punjab in a cluster, Karnataka, Uttar Pradesh & Tamil Nadu in another cluster and rest states in other cluster, etc

Figure 1.4 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2015-16



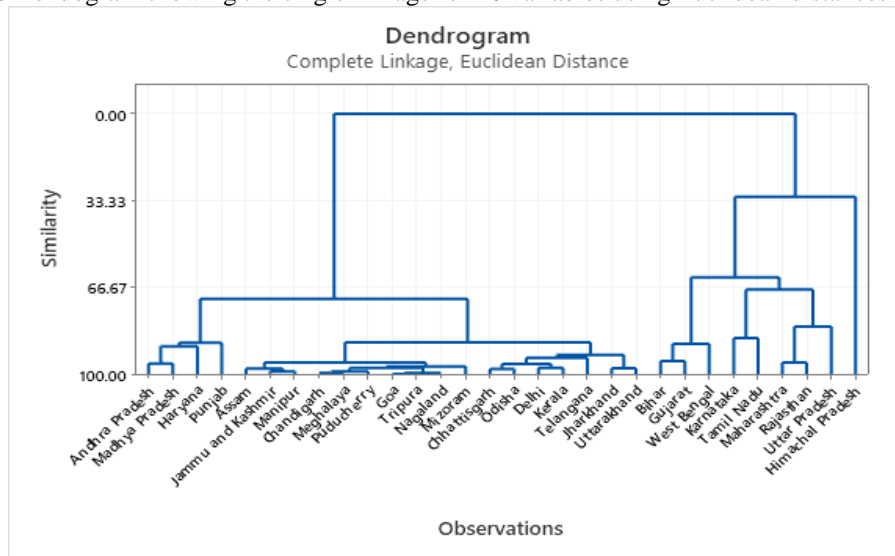
It is being observed that only Tamil Nadu in a cluster and other states in another cluster. On the second linkage, Tamil Nadu in a cluster, Andhra Pradesh, Karnataka, Madhya Pradesh, Telangana & Punjab in another cluster and rest states in other cluster, etc

Figure 1.5 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2016-17



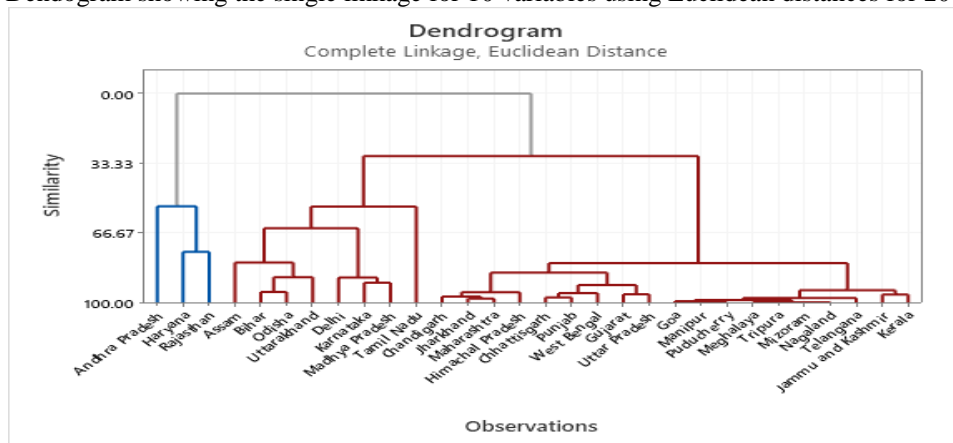
It is being observed that Andhra Pradesh, Rajasthan, Karnataka, Madhya Pradesh, Maharashtra & Uttar Pradesh in a cluster and other states in another cluster. Etc

Figure 1.6 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2017-18



It is being observed that Himachal Pradesh, Uttar Pradesh, Rajasthan, Karnataka, Maharashtra, Tamil Nadu, West Bengal, Gujarat & Bihar in a cluster and other states in another cluster. etc

Figure 1.7 Dendrogram showing the single linkage for 10 variables using Euclidean distances for 2018-19



It is being observed that Andhra Pradesh, Rajasthan & Haryana in a cluster and other states in another cluster. etc.

II. REMARKS

Classification of the states using UNSDG goals have been done earlier for a particular year (Ghara 2016). Using PCA and Cluster Analysis, the education development indicators have been chosen. The weighted average of selected variable's standard scores have been calculated. Based on the education development indicators for higher education, the states have been classified and ranked. It is an attempt to classify the states of India based on higher education development indicators. The most upcoming better state in higher education may be Haryana and Andhra Pradesh.

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