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Comparative study of literacy rate in Telangana state and India using holt's double exponential smoothing approach

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Abstract
Literacy is the key for socio-economic progress. Although literacy rates are improved after the independence, the level of literacy is still below the world average literacy rate of 84% and of all nations. India currently has the largest illiterate population. Despite governments' motivation, India's literacy rate increased only sluggishly and recent research literature suggests that it would take until 2060 for India to achieve universal literacy at then-current rate of progress. The current survey of 66th round of NSS estimates indicate that in 2009-10, less than two-thirds (66.8%) of the population of all ages were literate. The overall disparity in literacy across the population is heightened by the presence of rural- urban and male-female disparity. This paper analytically discusses the literacy rates and educational level of different social groups based upon various rounds of NSSO estimates. This paper has been divided into three levels. In the first level literacy rate among Telangana states of Top districts including Rural and Urban areas is discussed. In the second level growth rate of literacy from India was presented. In the third level comparative study of literacy rate from Telangana state and India is presented. In the final stage statistical analysis and forecasting of Literacy rate using Holt's Exponential Smoothing method is used.

Keywords: Literacy rate, rural, urban, gross enrolment ratio, holt's double exponential smoothing

Introduction
Literacy is the important tool to explore the human abilities which effectively and efficiently contributes economic growth the country. Literacy is a systematic process from which a child or adult acquire the knowledge, skills, experience, systematic exposure and good attitude. Educational opportunities possible by literacy, it is the heart of basic education for all the civilization, and essential for poverty, reducing child mortality, reducing population growth, improve the gender equality and sustainable development.
Literacy and level education affect the human behavior and it improves the attitude of the person and vision of the carrier. Literacy is an indicator of level of development achieved by the society. Spreading of literacy is the associated with development of modern civilization such as modernization and urbanization of the nation. Socio economic and Socio-political achievement of the nation depends on the literacy and educational level of residents of the nation.

Data base and Methodology
This paper studies the comparative study of Telangana state and India from Rural and Urban area and the data was collected as secondary data from the following sources have been used to collect data:-
1. Directorate of Economics and statistics of Telangana state.
2. Census report 2001, 2011 of government of India.
3. United Nation Human Development report.
4. India stats.com.
5. Knoema.com
6. NSSO.

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For studying population literacy of Telangana and India the data has been collected from the census 2001 and 2011. In this paper comparative study of Telangana and India has been done using 40 years literacy data. For analysis and forecasting the literacy Holt's exponential smoothing methodology is used.
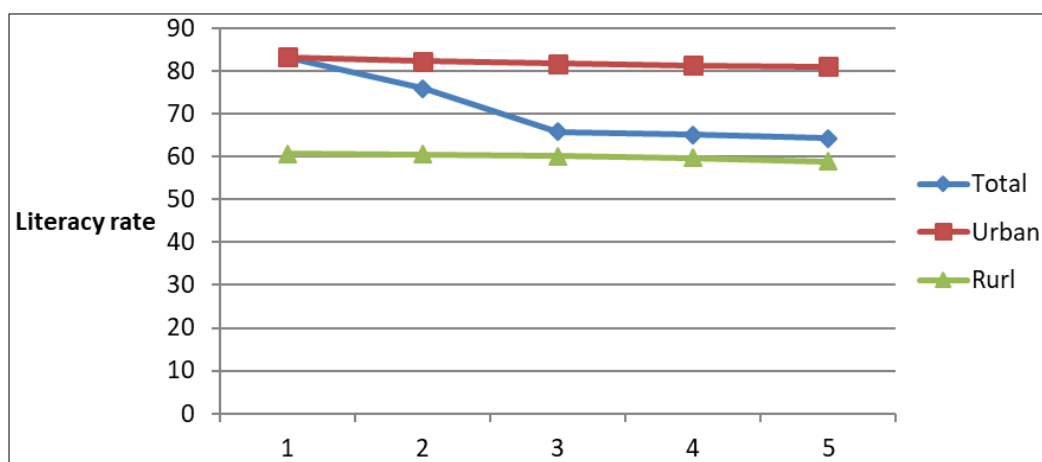
Definition of Literacy
- A person who can able to write and read with understanding in any of the language is considered as a literate

- A person, who can only read but cannot write, is not literate In the Censuses prior to 1991; children below 5 years of age were treated as illiterates. It was decided at 1991 Census that all children in the age group 0-6, would be treated as illiterate
- The population aged seven years and above only would be classified as literate or illiterate. The same criterion has been retained in the Censuses of 2001 and 2011.

Table 1: Literacy rate of top districts from Telangana State Census-2011

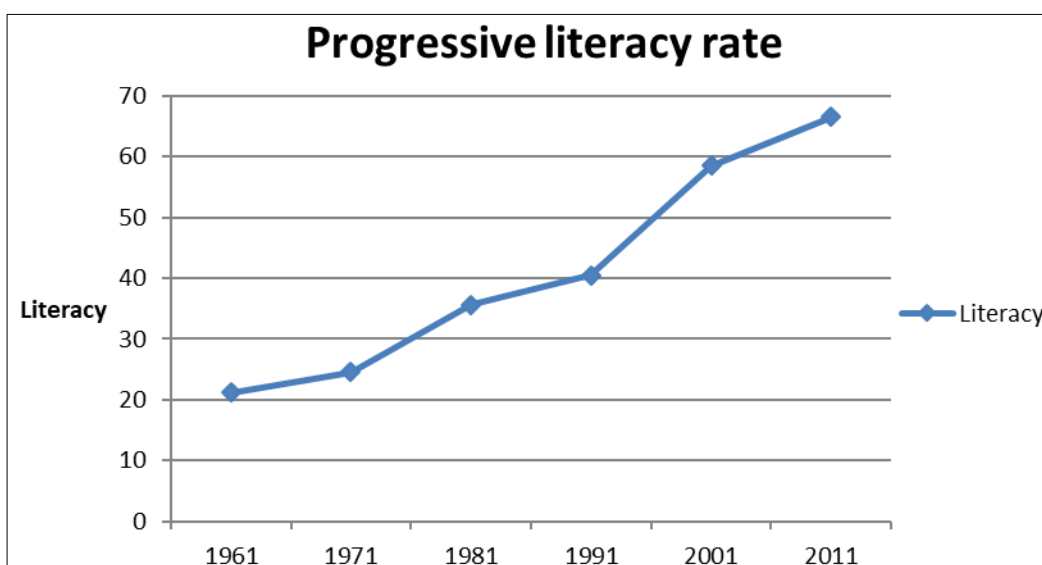| Districts	Literacy	Rank	Districts	Rural	Rank	Districts	Urban	Rank
Hyderabad	83.25	1	Rangareddy	60.6	1	Hyderabad	83.25	1
Rangareddy	75.87	2	Khammam	60.52	2	Rangareddy	82.31	2
Khammam	65.75	3	Nalgonda	60.07	3	Nalgonda	81.69	3
Warangal	65.11	4	Karimnagar	59.61	4	Khammam	81.26	4
Nalgonda	64.2	5	Warangal	58.83	5	Warangal	81.03	5

Top Districts literacy Rate

From the literacy census-2011, highest literacy is recorded as 83.25% from the Hyderabad which is 25.11% more compare with total literacy of 66.54. From the rural literacy, the highest literacy is recorded is 60.6%from Rangareddy district which is 05.76% more compare with rural literacy of 57.30%. From the Urban literacy, the highest literacy is recorded is 83.25%from Hyderabad district which is 02.66% more compare with urban literacy of 81.09%.

Table 2: Literacy rate of Telangana State from 1961-2011

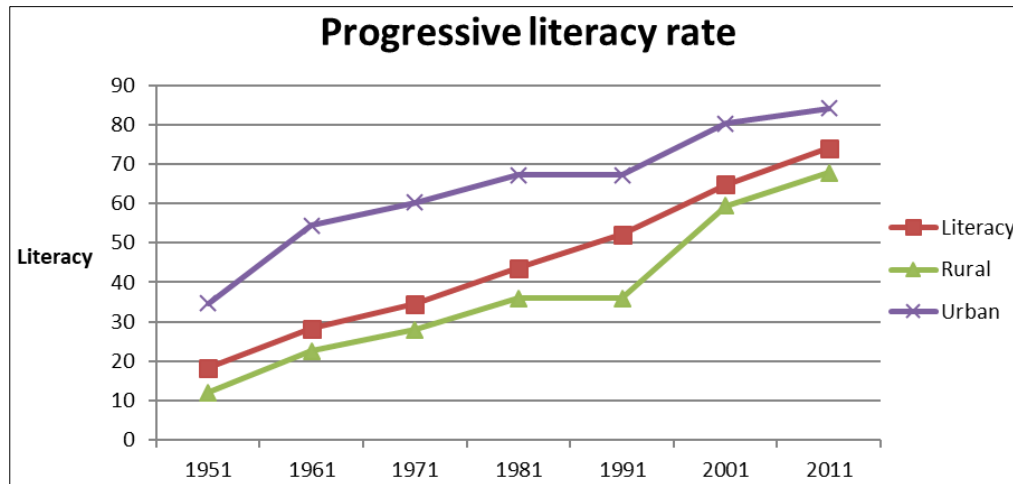| Years	1961	1971	1981	1991	2001	2011
Literacy	21.19	24.57	35.66	40.5	58.5	66.46

Graph 1: Graphical representation of Progressive literacy rate of Telanga State

After formation of the State in 1956, the first census was conducted in 1961 where in the literacy rate was recorded as 21.19 for the State. It grew to 66.46 in 2011 showing a substantial increase over a period of 50 years. This increasing trend is observed in all the Districts in the State.

Table 2: Literacy Rates in Post Independent India

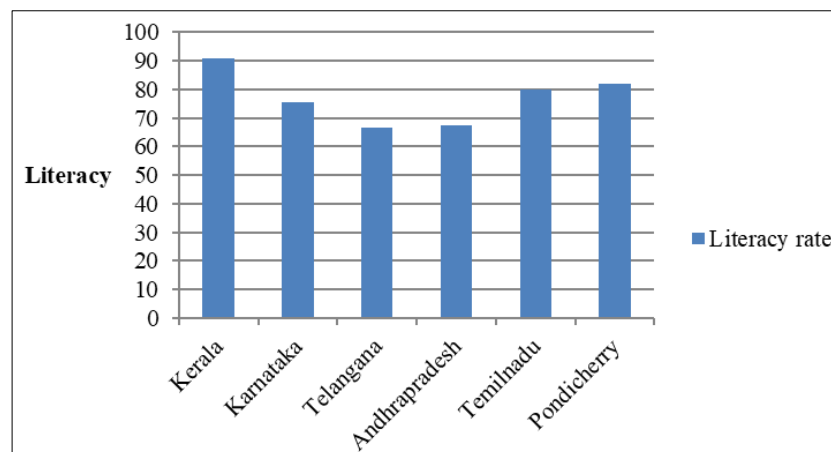| Years	1951	1961	1971	1981	1991	2001	2011	% increase in 2011 over 2001
Literacy	18.32	28.31	34.45	43.57	52.21	64.83	74.04	14%
Rural	12.1	22.5	27.9	36	36	59.4	67.8	14%
Urban	34.59	54.4	60.2	67.2	67.2	80.3	84.1	5%

Graph 2: Graphical representation of Progressive literacy rate from 1951-2011

From the graph, Literacy trend is observed it as progressive from the year 1951 to 2011. The growth rate from the year-2001 to 2011 is observed as 1.42%. Similarly From the rural literacy, growth rate from the year 2001 to 2011 is 1.41% and Urban literacy growth is 0.47%. There is need to improve the rural literacy rate compare with total and Urban literacy as to maintain progressive literacy in rural areas.

Table 3: Comparison of southern state literacy rate

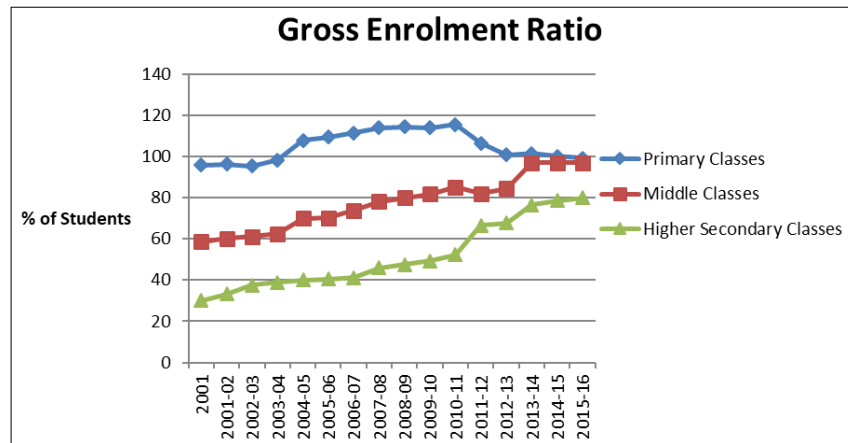| State	Literacy rate
Kerala	90.86
Karnataka	75.36
Telangana	66.5
Andhrapradesh	67.41
Temilnadu	80.09
Pondicherry	82.01

South India Literacy rate

From the graph, Literacy rate of Telangana state (66.50%) is expected to lower than the other states literacy, it indicates that it is necessary to improve in literacy by introducing new schemes in education sector of the Telangana state.

Gross Enrolment Ratio
Gross enrollment index is the statistical tool which helps in the education field and by the UN in its Education Index to determine the number of students enrolled in the school at different grade levels (like Primary, Middle and Higher secondary) and used to show the ratio of the number of students who live in the country to those who qualify for the particular grade level. The United Nations Educational, defines 'Gross Enrolment Ratio' as the total enrolment within a country "in a specific level of education, regardless of age, represented as a percentage of the population in the age group corresponding to this level of education. The Ministry of Human Resource Development (MHRD) informed that the Gross Enrolment Ratio (GER) for Higher Education in India increased to 24.5 percent during 2015-16. This is a positive step toward increasing the rate of literacy in the country.

Graph 3: Gross Enrolment Ratio in Different Stages of Education as Percentage of Population in the Appropriate Age groups
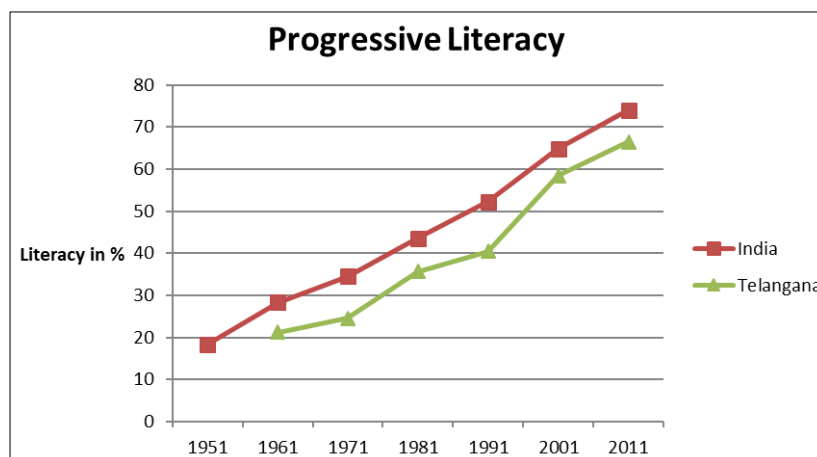
Index: Primary Classes I-V (6-10 years); Middle Classes VI-VIII (11-13 Years); Higher Secondary Classes IX-XII (14-18 Years):

Gross enrolment ratio indicates from the graph that in higher secondary level number of students joining in the educational institution is continuously increasing; it is a good sign to increase the literacy rate of India.

Table 4: Comparison of Telangana state and India literacy rate

Years	1961	1971	1981	1991	2001	2011
Telangana	21.19	24.57	35.66	40.5	58.5	66.46
India	28.31	34.45	43.57	52.21	64.83	74.04

Graph 4: Graphical representation of Progressive literacy in India

Forecasting Literacy rate of Telangana State

Methodology: For forecasting the time series data of literacy rate of Telangana state, the best Methodology is Holt's.

Double Exponential Smoothing Method

Holt's method is the revised smoothing method than Simple exponential smoothing method, which is applicable to the time series data with trend and no Seasonality. Mainly this method is a linear combination of previous value of a series for generating and modeling the future values. Application of

Holt's method required three equations,

Forecast = Estimated level + Trend at most recent time point

$F_{t+k} = L_t + T_t * K$

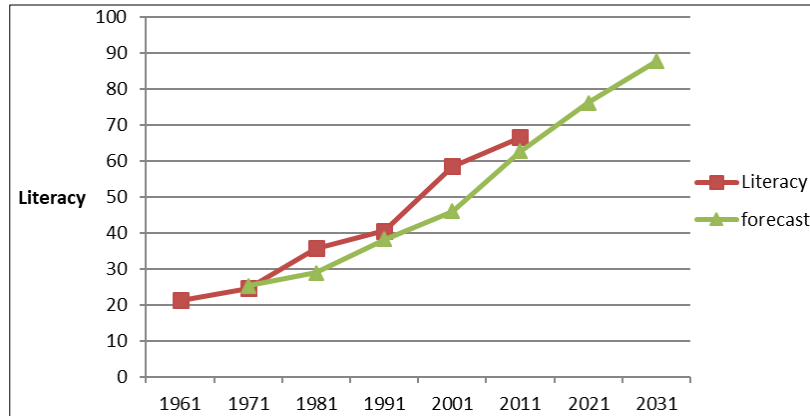Where, F_{t+k} represents forecast for m-steps ahead period. K represents no. Of period forecast.

Estimated level = $L_t = \alpha * Y_t + (1- \alpha) (L_{t-1} + T_{t-1})$

Estimated trend = $T_t = \beta (L_t - L_{t-1}) + (1- \beta) * T_{t-1}$

Table 5: Telangana literacy forecasting is as follows

Year	Literacy	Lt	Tt	Forecast	e	e^2
1961	21.19	21.19	4.11			
1971	24.57	24.935	3.891	25.3	-0.73	0.5329
1981	35.66	32.243	5.9412	28.826	6.834	46.70356
1991	40.5	39.3421	6.63594	38.1842	2.3158	5.36293
2001	58.5	52.23902	10.39253	45.97804	12.52196	156.7995
2011	66.46	64.54577	11.54106	62.63155	3.828452	14.65704
2021				76.087		224.0559
2031				87.6279		

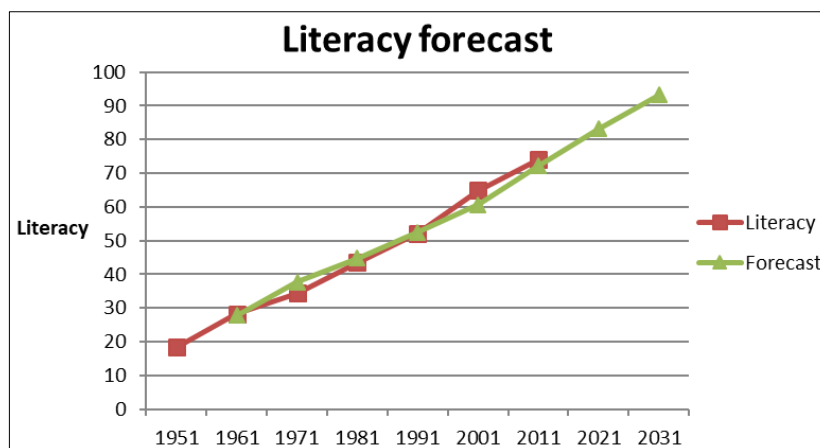| Alpha	0.5
Beta	0.6
SSE	44.81118

Literacy forecast

From the graph, forecasting the literacy in the year 2021 is 76.09%, there is 1.44% growth in literacy is observed it from the year 2011.

Forecasting Literacy rate of India

Year	India	Lt	Tt	F	e	e^2
1951	**18.32**	**18.32**	**9.555**			
1961	28.31	28.0925	9.6855	27.875	0.435	0.189225
1971	34.45	36.114	8.6871	37.778	-3.328	11.07558
1981	43.57	44.18555	8.31777	44.8011	-1.2311	1.515607
1991	52.21	52.35666	8.229774	52.50332	-0.29332	0.086037
2001	64.83	62.70822	9.502844	60.58643	4.243566	18.00785
2011	74.04	73.12553	10.05153	72.21106	1.828939	3.345019
2021				83.17706		34.21932
2031				93.22858		

Alpha	0.5
Beta	0.6
Error	5.703221

Literacy forecast

From the graph, forecasting the literacy in the year 2021 is 83.18%, there is 1.25% growth in literacy is observed it from the year 2011. By comparing the growth in forecasted literacy form the Telangana state and India, Growth rate in Telangana is higher than India. It is a good sign of improving the Telangana literacy in future.

Conclusion
An analysis of this paper concludes that the overall literacy rate of Telangana State is increased from the census-2001 to census-2011and the same trend is followed in India literacy rate. The growth rate of literacy in Telangana state is slight higher than India literacy as forecasted literacy is concerned. Telangana state government need to initiate more schemes which are related literacy in rural area to increase the literacy rate as compared with urban literacy. This paper predictive analysis is useful for the understanding the literacy from rural and urban area, the forecasting the literacy from Telangana and India is may helpful to the introducing new educational schemes for increasing in the literacy rate. In further study

new statistical tool may helpful to the analyzing and forecasting the future literacy in effectively.

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