Research Article

Evolving Trends in Computer Availability in Indian Schools and Households: A State-Level Comparative Study

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Abstract

The education system across the world has undergone major transformations in the technological domain of knowledge. As a result, computer education, in its own way, has managed to make a permanent place for itself in our daily life and education sector. Yet, our schools, mainly government schools, are not well-equipped in terms of infrastructure facilities. The present study focuses its analysis on access and use of computers and internet facilities in schools and households of India using various data sources such as District Information System on Education (DISE) 2014-15, 2021-22 and 71st and 75th rounds of National Sample Survey (NSS) data. This study tries to capture the spatial pattern of the use of computers in schools and households across the country. As per DISE 2014-15, only 26.4 per cent of schools in India had computers, which increased to 47.51 per cent in 2021-22. Out of this, about two-fifths of them were found non-functional. The possession of any type of computer and internet connection by households in India has also been found to be very low. In rural India, only 6 per cent of households had any type of computer, and 16 per cent had internet connections, as per 71st round of NSS data. The conditions in urban areas are better than those in rural areas. Variations were found at the level of gender and location, i.e. rural-urban. The proportion of urban males (aged 14 years and above) with the ability to use computers for various purposes is more than three times of their rural counterparts. In rural areas, the proportion of females are almost half of that of males for different types of abilities to use computers. Apart from this, regional variations have also been observed regarding the ability to use computers for various purposes.

Keywords: Use of Computers, Internet, Elementary school, Household, Spatial pattern of use of ICT.

Introduction

The use of computers and the internet is growing day by day at high speed. Almost all businesses, companies, and schools use computers for various official operations. The IT sector at the global and national levels has generated massive employment in the past and continues the trend of providing jobs. With online shopping, social media and cloud computing flourishing more than ever before, there is great demand for IT professionals in e-commerce and business. The majority of the employment is in the organized sector. Southern states, including Maharashtra account for 73 per cent of all jobs in computers and its related activities (NSS, 2009-10). The internet industry in India is likely to double to reach US$ 250 billion by 2020, growing to 7.5 per

cent of gross domestic product (GDP). The number of internet users in India is expected to reach 730 million by 2020, supported by the fast adoption of digital technology, according to a report by the National Association of Software and Services Companies (NASSCOM, 2012).

National Policy on Information and Communication Technology (ICT) in School Education (2012), Department of Education and Literacy, MHRD, Govt. of India had a mission to devise, catalyse and sustain ICT and ICT-enable activities and processes in order to improve access, quality and efficiency in the school system. Its goal is to create an environment to develop a community knowledgeable about ICT.

Objectives

- With the growing industry of computers and its related activities, are Indian schools, particularly elementary schools and households equipped with computers adequately?
- Is the common population able to operate computers comfortably with ease?

Database

The secondary databases used for the study are: District Information System on Education (DISE), 2014-15 and 2021-21 and National Sample Survey Report No. 575 (2015). These are the data sources used widely across the country. It also helps in getting the trend in the use of computers and provides a larger perspective with data under various heads, i.e. school-level, household-level, gender and location.

Literature review

Sinha et al. (2020), in their paper, conducted a comparative study among five government schools in urban areas and five rural schools located in the Ranchi district of Jharkhand, India. The objective of their study is to highlight the effectiveness of computer learning among school-going teenagers, with the help of various statistical analyses such as student t-test, fisher-exact test, and chi-square test. They observed differences in attitude, awareness, and effectiveness of computer education among boys and girls ranging from 11 to 17 years of age group. The results of the study showed that most of the students achieved basic computer knowledge at the age of 13 years. However, it was observed that girls achieved basic computer education better than boys, but boys achieved advanced computers much better than girls. This situation dramatically changed as both boys and girls registered low scores on computer studies as they had to assist their parents in the family earnings and work. Moreover, the study depicted that there is a huge gap between governmental recommendations and advertisements on the one hand and the growth of computer education in our country on the other.

A significant difference in interest towards computer education between the teachers of rural and urban areas was stated by Gupta and Patel (2016). A significant difference was also observed between the students of rural and urban areas towards computer education, in which the interest of the students of urban areas was more significant.

The role of computer and information technology in the field of education and how it makes teaching-learning processes enjoyable to readers has been discussed by Dabas, N. (2018). She also made a sharp demarcation between classroom teaching guided by computers in earlier days and today's computer education system. This paper presents that computers and their related techniques have completely

changed our present quality of education and become an indispensable part of our lives. Distance learning, online examination, monitoring, and computer-aided learning are some of the benefits of computers in Education. Nonetheless, computer and information technology not only provide successful learning programs but also increase the retention capacity of students.

Kumar and Kumar (2020), on the basis of their study, say that computers are mostly used by students and teachers in universities, libraries and other academic pursuits, with the majority of respondents being men, indicating gender discrimination, which still needs further improvement. The majority of the male respondents used a computer every day compared to female respondents. The study recommends that the university authority needs to provide a congenial environment for female respondents by providing free hostel facilities on the campus for the optimum use of computers and other ICT facilities. Most of the respondents have a highly positive attitude towards the use of computers. In this context, it is suggested that the concerned university authorities need to provide more computer facilities with Internet connections and ICT-based learning programmes to the students and faculty members so as to enhance their academic activities.

Raja and Naga Subramaniumi (2018) say technology has a positive impact on education and at the same time may also pose negative effects. Teachers and students should take advantage of this in a good light and eliminate the drawbacks which are pulling back many students as well as schools from achieving excellence. It is thus time for every country to introduce a more technologically equipped education sector in the future.

Upadhyay, P. (2016), in his paper, surveys the research work done on the theme: the advent of information and communication technology at the school level in the contemporary period as well as the effectiveness of information and communication technology at the primary level in the Indian context. With the help of many references, he shows that ICT brings benefits to the teaching-learning style and provides rich educational materials for students, teachers, and schools. He revealed that despite the immense importance of ICT in teaching-learning processes, India faces major drawbacks whether in terms of access to ICT facilities or capabilities of teachers, and infrastructural facilities at schools. He reported that even after launching two educational programs such as 'Gyanvani' and 'Gyandarshan' for students from primary to university levels, the adaptation of modern techniques in teaching-learning processes is a big question in India. He used the dataset from 1984-85 to 2007 to assess the quality of learning aided by ICT in various Indian states and thereby concluded that although the government has invested millions of rupees in strengthening computer-aided learning, most of the schools are lagging behind in achieving the target. To ameliorate this adverse situation, he urged modification in teaching skills and responsibilities of schools to enhance the successful implementation of ICT in schools.

Yadavet al., (2016) in their paper documented the challenges and experiences encountered by computer science teachers of the USA in their schools to meet the growing demand for computer science education. Not only in the United States of America, the push for introducing computer science education is a common phenomenon even in the curriculum of primary and secondary classes all across the

world. They selected twenty-four high schools from across the United States of America to understand the challenges faced by computer science teachers in their classrooms. They interviewed 24 teachers with the help of a questionnaire to address the challenges. They arranged the interviews to put it to qualitative analysis software called Dedoose, which generates 58 codes from the raw data. The codes were broadly divided into eight conceptual themes and then categorized into three classes: all-embracing challenges, professional needs, and factors affecting teaching in a computer science classroom. The study suggests that computer science teachers should indulge themselves in community teaching, which develops habits of practice teaching with each other and provides opportunities to reflect on their thinking as well as gain pedagogical perspectives.

The importance of ICT integration to support teaching-learning processes in schools of Malaysia was described by Ghavifekr, S., and Rosdy, W. A. W. (2015). The main aim of their study is to analyze the effectiveness of ICT integration for both teachers and students through teachers' perceptions. Random sampling was done with the help of a survey questionnaire from ten public secondary schools in Kuala Lumpur, Malaysia. Raw data were obtained from 101 teachers and a quantitative method was followed for this research. The data were analyzed using SPSS software for both descriptive and inferential statistics. The results show that professional training programs for teachers played a key role in enhancing quality learning among the students and also helped in strategic planning and educational policymaking for the country.

Methodology

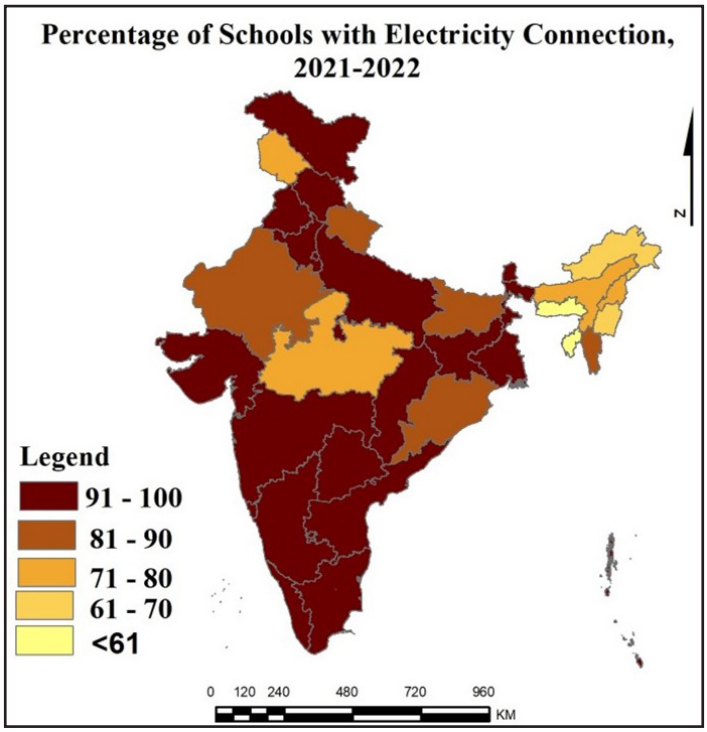
In the present study, both qualitative and quantitative works have been done in this study. This comprehensive study is descriptive in nature, encompassing all the relevant facts and figures based on secondary data sources. Some graphical representations have also been used to represent the data more meaningfully.

Analysis

Electricity in schools in India

The use of ICT has some prerequisites, and the availability of electricity is one of them. So, apart from being an essential part of our day-to-day life, electricity is required as the basic infrastructure for running electrical equipment and, here, computers. But, all the schools in India do not have the provision of electricity. In India, only 60 per cent of schools had electricity in 2014-15. Some states performed poorly, and some states had a percentage more than the national average. Some of the northern states like Jharkhand, Assam, Bihar, Jammu & Kashmir (J&K), Madhya Pradesh (M.P.), Odisha, Uttar Pradesh (U.P.), Rajasthan and West Bengal had figures below the national average. Jharkhand and Assam had figures below 20 per cent. Some states/UTs, like Kerala, Karnataka, Gujarat, Punjab, Chandigarh and Delhi, had more than 90 per cent of schools with electricity connections. The situation improved by 2021-22 (as seen in Fig-1), with the majority of the states and UTs of India having more than 80 per cent of schools having electricity. The national average was found to be 89.34 per cent. The northeastern states and some of the states/UTs like M.P and J&K still had many schools with no electricity connection.

Fig.-1 (Source: UDISE 2021-22)

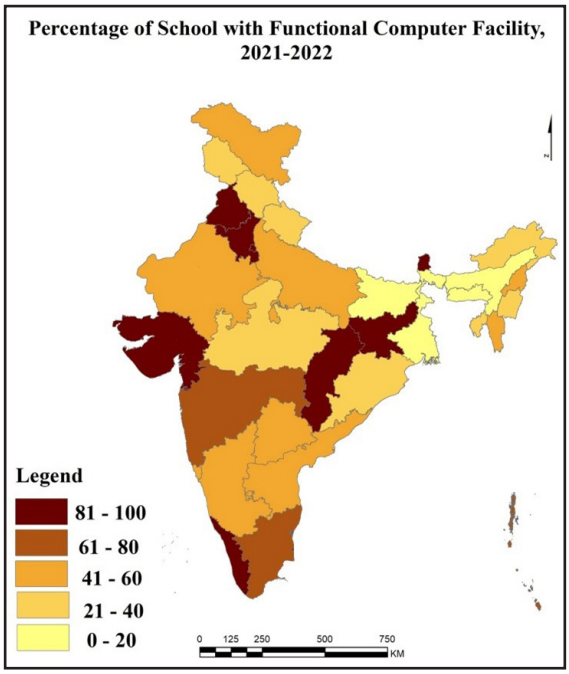


Availability of computers (and functional computers) and Internet in schools

The use of computers has become a part of the curriculum in the school system of India. It not only helps generate the required skills among the students for using computers, but it also helps in incorporating ICT into pedagogy in teaching-learning practices. NEP 2020 also suggests adequate use of computers in teaching-learning at various stages of education (NEP 2020). UDISE+ (Unified District Information System for Education Plus) reports of 2014-15 and 2020-21 show that in India, the percentage of computer facilities available in schools was 25.2 per cent in the year 2014-15, which increased to 41.25 per cent in 2020-21. There were spatial variations, with some of the southern and western states/UTs like Gujarat, Kerala, Tamil Nadu, etc. having higher percentages of computer availability. On the other hand, northern states and northeastern states performed poorly.

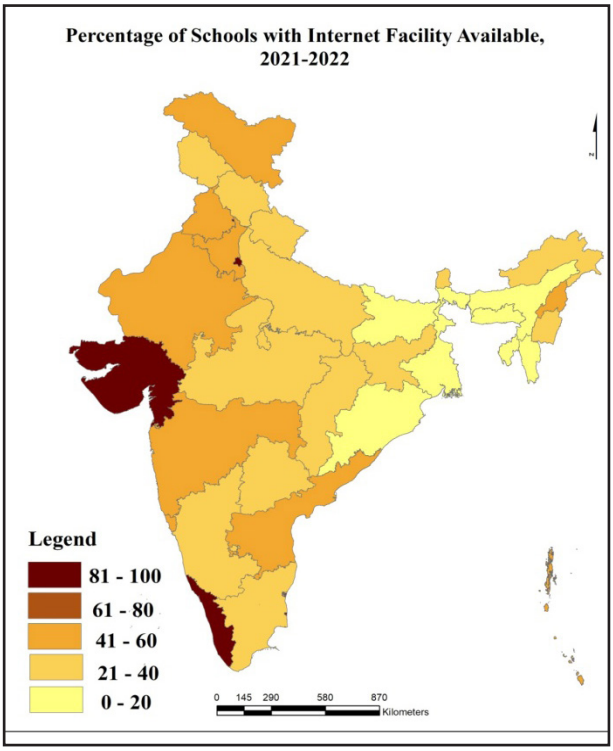
Apart from the availability of electricity and computers, it is also important to have functional computers available for use by learners. UDISE reports of 2014-15 and 2020-21 show that in the majority of the states/UTs, a large percentage of schools did not have functional computers. Some larger states like Chhattisgarh, Jharkhand and Rajasthan were found to have improved their conditions from 2014-15 to 2020-21. The figures for the year 2021-22 (Fig.-2) still show that except Kerala, Punjab, Haryana, Gujarat, Chhattisgarh, Jharkhand and Sikkim that had more than 80 per cent schools with functional computers, the majority of the states/UTs performed poorly in this parameter as against the national average of 95.25 per cent.

Fig.-2 (Source: UDISE 2021-22)



All these figures point out the poor maintenance of computers and their use at school, even if their availability is there as an infrastructure. Even though the schools now have made computers available as an infrastructure, they are not available for use in the teaching-learning process.

Fig.-3 (Source: UDISE 2021-22)



The Availability of the Internet at schools can be considered as another indicator to determine the level of use of ICT in schools. As fig-3 shows, barring Delhi, Rajasthan and Kerala, the majority of the states/UTs of India average to have poor availability of internet facilities in schools. The national average was found to be around 33 per cent, meaning only this high percentage of schools had internet facilities in them. The western and southern states performed better than the eastern and northeastern states. Internet facilities not only ensure easy communication of the school as a unit with other organizations but also good connectivity within the school. It also helps in the use of internet for pedagogical use in teaching-learning.

Availability of Computers at the Household level

Apart from schools, the availability of computers at home for the use of households is also an important variable to determine the use of computers. As the data source (NSSO) shows, about 6.2 per cent of households had computers in their home in rural areas, which decreased to 4.4 per cent (a decline of 2.2 per cent) till the survey year of 2017-18. In the case of urban households, the percentage was 29.2 per cent which also decreased to 23.4 per cent, i.e. by about 5 per cent till the survey year 2017-18.

States like Chattisgarh, Odisha, Bihar, Jharkhand, West Bengal, Madhya Pradesh, Tripura, UP, Assam, Karnataka and Manipur had lower percentages of availability of computers in rural areas than that of the national average. On the other hand, states like Maharashtra, Tamil Nadu, Punjab, Himachal Pradesh, Puducherry, Daman & Diu, A & N Islands, Nagaland, Sikkim, Mizoram, Kerala, Delhi, Chandigarh, Lakshadweep and Goa had a higher percentage in rural areas than the national average.

It must be noted here that the report does not capture the availability of smartphones and other handheld devices.

Availability of Internet facilities at the Household level- Rural

The availability of the internet is related to the use of computers but makes an important aspect while assessing the use of ICT. The national average of internet access in households came to nearly 24 per cent till the survey year 2017-18. The figures were 15 per cent in the case of rural and 42 per cent among urban households. From the previous year, the decline in internet availability was noticed by 1.1 per cent and 6.7 per cent in rural and urban households, respectively.

Table-1: Households with internet facilities for different States of India

Range of categories (%)	Rural	Urban
< 40 Poor	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal	Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Odisha, Tamil Nadu, West Bengal

41-80 Average	Himachal Pradesh, Kerala	Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Punjab, Rajasthan, Telangana, Uttarakhand, Uttar Pradesh
>80 Good	None	None
All India	14.9	42

(Source: NSSO 75th Round 2017-18)

The distribution of states/UTs as per the availability shows that the majority of the states in India had low, i.e. less than 40 per cent, availability of internet facilities in rural areas. Only two states namely, Himachal Pradesh and Kerala, had access to internet facilities in 41-80 per cent of households. However, households in urban areas had better access to internet facilities and northern as well as western states seemed to perform better (average level) as compared to other parts of the country. None of the states had more than 80 per cent of households with access to internet facilities. Details on tools used on computers and the internet are given in the tables given in the appendices.

Conclusion

In the present times, when the world and even the Indian government are working extensively for digital transformation, many schools and households of India are still deprived of basic infrastructural facilities like availability of computers and internet facilities. It is important here to note that the Samagra Shiksha scheme of the Government of India, launched in 2018, ensures the availability and use of ICT-related infrastructure in schools. This scheme is an integrated scheme for school education covering all the stages, i.e. from pre-school to class XII. The scheme treats school education as a continuum and is also in accordance with **the Sustainable Development Goal for Education (SDG-4).** The scheme provides support for the implementation of the Right of Children to Free and Compulsory Education Act, 2009 (RTE). Along with this, it has also been aligned with the recommendations of **National Education Policy (NEP) 2020**. The ICT and Digital Initiatives component of Samagra Shiksha covers all the Government and Aided Schools having classes VI to XII. Under this component, financial assistance is provided for establishing ICT labs and Smart Classrooms in schools. The non-recurring and recurring grants under 'ICT and Digital Initiatives' are available to the States and UTs for proper implementation of this scheme.

Despite such schemes launched by the government, though the availability of computers in schools all across India has increased, the availability of functional computers is another point of concern. There seem to be large variations in the availability of these facilities across the country at various levels. Internet access at school was also found to be below 60 per cent of schools in most parts of the country. Variations were also found at the state and UT levels, where western and southern states seem to perform better than some of the northern and eastern states. Similarly, access to computer and internet facilities at the household level was poor in most parts of the country. As compared to the schools, the performance of households was poorer in the availability of the two ICT-related infrastructures. The schemes (Samagra Shiksha and schemes prior to this) launched by the government to ensure ICT facilities at schools can be the reason behind this.

The IT and ITE sector has generated massive employment in the past and continues to provide jobs. However, the percentage of properly functional computers, even at schools in some of the states of the country, is as low as 40 per cent. There is a big gap between rural and urban households having computers and their knowledge of operation. Such situations pose a question mark on the efforts made at the level of formulation policy and program and at the stage of implementation. Infrastructures related to computer education in schools need an enhancement in the present, times for which the availability of basic infrastructures related to that is a prerequisite. Basic knowledge of computers of common people also needs to be enhanced- at the household level.

These pose a few questions: Having such variations in the availability of computer-related infrastructures at the school and household level, how does India aim to bring digital revolution and transformation in society? What sort of impact have campaigns like Digital India made on the availability of infrastructure related to computer education? Whether the availability of computers in households should also take into consideration the availability of handheld devices like smartphones and tablets? The present study, therefore, generates these questions, which can be further analysed.

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Appendices

Table-1: Persons aged 14 and above having knowledge of Word, Search and Email (Rural & Urban)

States/UTs	Rural			Urban			Total		
	Word	Search	Email	Word	Search	Email	Word	Search	Email
Andhra Pradesh	7.3	6.7	6.3	25.6	24.7	23.5	13.2	12.5	11.8
Arunachal Pradesh	11.8	10.8	9.5	28.4	25.1	23.2	14.5	13.2	11.8
Assam	6.1	5.6	4.6	28.6	27.3	26	9.1	8.4	7.4
Bihar	3.3	3.5	3.3	19.1	19.3	17.3	5.1	5.3	4.9
Chattisgarh	2.5	2.2	1.8	17.8	17.2	15.5	5.5	5.1	4.5
Delhi	27.3	28.2	26.8	39.8	40.1	39.3	39.4	39.7	38.9
Goa	34.5	28.9	26	40	34.8	32.5	37.7	32.4	29.9
Gujarat	10.3	8.6	7.9	29.2	26.1	24.3	18	15.8	14.6
Haryana	12.1	11.1	8.7	33.4	31.3	29	19.2	17.8	15.4
Himachal Pradesh	18.3	17.3	15.9	39.6	38.4	37.9	20.6	19.6	18.3
Jammu & Kashmir	8	8.6	6.5	23.6	24.6	21.7	11.3	12	9.7
Jharkhand	4	3.8	3.4	21.8	21.8	20.4	7.9	7.8	7.1
Karnataka	9.1	7.7	6.8	31.4	29.4	28	17.8	16.1	15
Kerala	29	25.3	22.7	37.9	34.2	32.5	33	29.3	27.2
Madhya Pradesh	41	4.1	3.6	23.5	24.1	21.7	9.5	9.7	8.6
Maharashtra	11.4	10.9	10.3	34.6	35.1	33.1	21.7	21.6	20.4
Manipur	4.6	6.6	4.7	8.6	12.9	9.6	5.9	8.6	6.3
Meghalaya	11.9	9.2	5.2	41.3	37.4	33.1	17.2	14.3	10.3
Mizoram	21.4	14.6	11.1	35.9	28.6	24.1	28.2	21.2	17.2
Nagaland	39.8	34.6	37	48.3	44.7	43.7	41.8	37	38.6
Odisha	4.5	4.3	4.2	21.4	21.2	19.6	7.5	7.3	6.9
Punjab	14.4	12.7	11.2	32.7	31.3	29.2	21.2	19.6	17.9
Rajasthan	8.3	8.1	7.1	24.7	24	21.1	12.8	12.5	11
Sikkim	19	19.1	19	45.4	47.1	46.3	24.2	24.7	24.4
Tamil Nadu	14.7	12.9	12	29.1	27.1	25.7	21.9	20	18.8
Telangana	8.7	8.7	8.5	28.8	27.6	27	16.3	15.9	15.5
Tripura	2.4	2.3	2.1	13.4	10.8	10.3	4.9	4.3	4
Uttar Pradesh	5	5.2	4.1	21.7	21.6	20.1	9	9.1	7.9
Uttarakhand	10	10.6	10	33.9	33.9	33.2	15.6	16.1	15.5
West Bengal	5.8	4.7	3.9	21.7	19.7	18	10.9	9.6	8.5
A & N Islands	14.6	12.1	11.3	27.9	22.6	19.2	19.6	16.1	14.3
Chandigarh	30.5	28.9	27.1	48.6	43.8	42.4	47.9	43.3	41.8

D & N Haveli	5.6	5	5	42.8	41.2	41.2	24.1	23	23
Daman & Diu	26.8	32.1	17.3	30.2	30.5	27.7	29.6	30.8	25.7
Lakshadweep	32	32.5	26.3	39.5	36.5	36.3	37.9	35.7	34.2
Puducherry	32.8	34.5	31.4	33.3	33.1	31.4	33.1	33.5	31.4
India	7.8	7.3	6.5	28.1	27.1	25.4	14.2	13.5	12.4

Source: NSS Report No. 575, 2016

Table-2: Persons aged 14 and above having knowledge of Word, Search and Email (Male & Female)

States/UTs	Male			Female		
	Word	Search	Email	Word	Search	Email
Andhra Pradesh	18.1	17.5	16.6	8.3	7.5	7
Arunachal Pradesh	18	16.2	14.5	10.6	9.8	8.6
Assam	11.3	10.4	9.6	6.6	6.2	5
Bihar	7.2	7.5	6.9	2.9	3	2.7
Chhattisgarh	7.4	7.2	6.3	3.6	2.9	2.7
Delhi	43.7	44.8	43.7	34	33.2	32.9
Goa	44	39.7	35.9	31.5	25.3	24
Gujarat	23.1	21.1	19.7	12.7	10.2	9.3
Haryana	23.1	22.5	20.1	15	12.8	10.5
Himachal Pradesh	25.5	24.4	23.2	15.8	15	13.6
Jammu & Kashmir	14.5	15.4	12.8	7.9	8.2	6.3
Jharkhand	11	10.9	9.9	4.7	4.4	4.1
Karnataka	22	20.6	19.4	13.7	11.7	10.7
Kerala	36.5	34.6	32.7	30	24.8	22.4
Madhya Pradesh	12.6	13	11.6	6.2	6.1	5.5
Maharashtra	26	26.7	25.1	17.1	16.4	15.5
Manipur	8.2	11.2	8.6	3.4	6	3.9
Meghalaya	18.1	15.9	11.4	16.4	12.8	9.3
Mizoram	30.7	23.4	19	25.8	19	15.4
Nagaland	48.4	45	44.1	35.4	29.2	33.3
Odisha	10	9.9	9.5	5	4.6	4.2
Punjab	25.4	24.1	22	16.5	14.5	13.2

Rajasthan	18.2	18	15.9	7.4	69	6
Sikkim	25.5	26.3	25.9	22.7	22.8	22.8
Tamil Nadu	25.9	24.5	23.4	18	15.7	14.5
Telangana	22.1	21.8	21.3	10.6	10	9.8
Tripura	6.6	5.9	5.6	3.3	2.6	2.4
Uttar Pradesh	11.7	12.1	10.4	6.1	5.8	5.2
Uttarakhand	21	21.7	20.7	9.9	10.1	9.9
West Bengal	13.7	12.4	11	8	6.7	5.9
A & N Islands	19.3	17.7	15.1	19.9	14.5	13.4
Chandigarh	51.2	48.2	46.4	43.6	36.8	35.8
D & N Haveli	28.2	27.8	27.8	19	16.8	16.8
Daman & Diu	30.5	32	27.7	27.9	28.7	22.1
Lakshadweep	47.2	44.6	43.8	27.8	25.9	23.7
Puducherry	39.1	40.7	37.6	27.3	26.6	25.4
India	17.7	17.3	16	10.6	9.5	8.7

Source: NSS Report No. 575, 2016