Decomposing the Digital Divide: Computer Literacy and Discrimination among Scheduled and Non-Scheduled Groups in India (15–59 Years)

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This digital divide reinforces inequities and hinders inclusive economic growth. Access to computers and digital resources in India remains uneven across social groups, with Scheduled Castes and Scheduled Tribes (SC/STs) experiencing significantly lower levels of access. This study examines digital discrimination experienced by these marginalised groups. Using data from the NSS 78th Round, 2020-21, Multiple Indicator Survey (MIS) for individuals aged 15 59, study examines the key dimensions of computer literacy in India. Our analysis reveals that 84 % of Indians lack computer literacy. Among the scheduled groups, only 9.4% are digitally literate compared to 19% of non-scheduled groups. In urban areas, 28.5% of non-scheduled individuals are computer literate, versus 17% among scheduled groups. The male digital literacy gap between these groups is 16% (22% vs. 38%), while the female gap is 6%. Using Oaxaca and Ransom's (1994) decomposition, we find that 86% of the literacy gap is explained by observable factors, with 14% remaining unexplained. Education contributes most to the disparity, accounting for 44%. These gaps risk deepening caste and gender inequalities and creating new digital divides. We recommend community-level interventions, including improved access to electricity and the internet in marginalised areas, to build social capital and promote digital inclusion.

Keywords: Digital discrimination, Scheduled groups, Endowment, Fairlie Decomposition, India

JEL Classification: J71, O38, O20

Introduction

In today's rapidly digitizing world, the ability to access and use computers is increasingly recognized as a vital skill for personal and professional development. Information and communication technologies (ICTs) empower individuals to participate more fully in the economy and society (Jin & Cho, 2015; Amiri & Woodside, 2017). The differential access to technology compounds existing inequalities and creates barriers in educational and economic opportunities (Chakradhar and Prashant, 2024). This disparity is intensified in rural areas where access to information technology is limited, especially among older adults and women (Moreno et al., 2023). Consequently, the technological gap can exacerbate existing social exclusions, limiting lower caste individuals' ability to engage within the socio-economic framework. In the Indian context, examining the determinants of computer literacy across social groups is crucial, particularly given the persistent stratification of society between Scheduled Castes (SCs) and non-Scheduled Castes (non-SCs).

Digital literacy is widely seen as a key enabler of empowerment, enhancing access to vital services, information and socio-economic opportunities. However, marginalised communities often experience significant barriers to digital inclusion, rooted in socio-economic and cultural factors (Hannemann et al., 2021; Santos et al., 2022). For instance, the intersectionality of caste and socio-economic status significantly contributes to the persistence of inequalities in accessing technology and the resultant opportunities (Pankaj, 2019; Mishra, 2023). Such disparities lead to lower participation in health care, education and employment, reinforcing poverty and social exclusion (Haenssgen, 2018; Dev, 2018). Moreover, this dual layer of discrimination can restrict access to educational opportunities that foster technological skills essential for navigating the modern job market, thus perpetuating a cycle of socio-economic marginalization (Weiss et al., 2018).

Access to digital resources in India remains highly unequal across social categories. Only 4% of SC/ST students have access to computers with internet connectivity, compared to 21% among the general category (Oxfam India, 2022). Expenditure patterns further highlight these disparities, with SC/ST households spending roughly half as much as the general category on mobile devices. Internet access is similarly uneven—only 14% among Scheduled Tribes, compared to 41% for the general category (Rajam et al., 2021). Such disparities in digital access and computer literacy serve as regressive forces for the Indian economy. Despite sustained national efforts toward digitalisation and automation, nearly one-third of the population—

primarily SC/ST groups—remains marginalised in their ability to utilise digital resources such as computers, mobile phones, and the internet.

This phenomenon may be understood as digital discrimination, a contemporary extension of traditional caste-based exclusion. Historically, SC/ST groups faced deep-rooted barriers such as untouchability, restricted access to resources, limited educational and occupational opportunities, and enforced low-prestige living conditions (Mayell, 2003). Today, these structural disadvantages persist in new forms: unequal access to ICT services restricts upward mobility and widens developmental gaps. Communities with greater digital access leverage technology for education, employment, and social advancement, while marginalised groups remain disconnected from these opportunities (Vaidehi, Reddy, & Banerjee, 2021; Majumdar et al., 2024). The importance of digital literacy has grown substantially over the past two decades, coinciding with the rapid expansion of India's information technology sector. The Y2K crisis of 2000, which spurred global demand for Indian software engineers, marked a turning point. Since then, ICT has become deeply embedded across economic sectors, from banking and trade to agriculture, industry, and education (Pushpanadham, 2019). While general education remains critical, digital literacy now defines participation in modern economic and social life.

Existing scholarship has predominantly focused on digital divides in developed economies, with limited attention to caste-based disparities in developing countries such as India. Recent studies provide some insight: Rajam et al., (2021), using data from the Household Social Consumption Survey (2017–18), employed non-linear decomposition to show how caste-based digital disparities are rooted in historical and ongoing socio-economic disadvantages. Similarly, Tewathia et al., (2020), drawing on the IHDS 2011, highlighted how education, caste, and household occupation shape digital access and usage patterns. Yet, these contributions remain limited by their reliance on broad or imprecise definitions of computer literacy, typically confined to the ability to "operate" a computer.

The present study extends this literature by offering a more substantive conceptualisation of computer literacy, encompassing competencies such as sending e-mails with attachments and creating electronic presentations. Using data from the NSS 78th Round (2020–21), it examines the extent and determinants of computer literacy across social groups in India. Specifically, the study addresses four research questions: (i) What is the overall level of computer literacy in India? (ii) What socio-economic, demographic, and geographic factors

explain disparities in ICT skills? (iii) How does the ability to use computers vary across caste groups? and (iv) to what extent do caste-based inequalities continue to condition access to ICT skills? By situating digital discrimination within the broader framework of caste-based inequality, this study highlights how persistent structural disadvantages constrain India's transition to an inclusive digital economy.

Contributions of the Study

This study makes four interrelated contributions to the literature on digital inequality and social stratification in India. First, it advances measurement by operationalising computer literacy as a competency-based construct built from multiple, concrete ICT tasks rather than a single self-reported proxy; the index is transparently defined and readily replicable. Second, it provides up-to-date, nationally representative evidence for the working-age population using the most recent large-scale microdata, yielding disaggregated estimates by settlement type, region, gender, and social group, and thereby documenting intersectional gaps that existing studies often obscure. Third, it strengthens explanation and inference through a modelling strategy aligned with the binary nature of the outcome: logistic regressions supplemented by Fairlie's non-linear decomposition quantify how much of the caste-based literacy gap is attributable to observable "endowments" (e.g., education, broadband access, device ownership) versus residual differences; split-sample estimates further reveal heterogeneous payoffs to these covariates across social groups. Fourth, it enhances policy relevance and reproducibility by translating decomposition results into actionable levers (prioritising education and last-mile digital infrastructure), mapping regional heterogeneity to guide geographic targeting, and documenting a transparent workflow—variable definitions, index construction, and estimation choices—that constitutes a template for ongoing monitoring at state and district scales.

Review of Literature

The ICT revolution has transformed global connectivity, embedding itself deeply into multiple dimensions of contemporary society. Previous studies have sought to define the digital divide and explain its underlying causes in this context. The OECD (2001) describes the digital divide as the gap between individuals or groups with access to and effectively utilizing digital technologies and those without such access and proficiency. Van Dijk (2008) define the digital divide as the disparity between individuals with and without access to emerging forms of information technology. This presents a significant societal challenge because uniform internet

access and utilisation are not guaranteed, which excludes substantial segments of the population from the digital community. The inaccessibility of digital services is prominent in developing countries such as India, where society is segregated on caste lines, generating graded inequalities among castes (Rajam et al., 2021). In this context, multiple research investigations have established that limiting access to digital technology for specific population segments can negatively impact economic progress and well-being. It can exacerbate societal disparities, including gender, social, and employment opportunities for marginalised groups (Haenssgen, 2018; Rajam et al., 2021; Agarwal & Malhotra, 2016; Tewathia et al., 2020). Notably, the study by Rajam et al., (2021) shows a significant disparity in digital access at both primary and secondary levels between marginalised caste groups and the rest of the population in India. A similar study by Tewathia et al., (2020) revealed notable disparities in ICT ownership and usage across various socio-economic groups in India. Marginalized groups need more ICT assets and the necessary skills to utilise them. By using the 66th and 68th rounds of National Sample Survey Office (NSSO) data, Agrawal and Asrani (2018) showed that the Scheduled tribes (STs) and Scheduled castes (SCs) exhibit a lower probability of possessing these ICT devices as compared to other castes in India.

Women's participation in the workforce and economic activities has risen over time, yet they continue to face significant gender-specific challenges in developing countries (Morrison & Jütting, 2005). A key contemporary concern is their access to and use of Information and Communication Technology (ICT). Despite notable advancements, many women remain excluded from the digital sphere, particularly in developing countries (Brussevich et al., 2018; Islam & Manchanda, 2022). In addressing persistent issues of gender inequality in developing nations, ICT plays a pivotal role by potentially resolving challenges related to equitable access to opportunities such as employment, income, education, and essential healthcare services (Hilbert, 2011). In their study, Bala and Singhal (2018) investigated the gender-based digital gap across six districts of Uttar Pradesh, India. Their findings indicated a prevalent divide between genders in these districts concerning the utilisation and accessibility of Information and Communication Technology (ICT) resources. Previous research indicates that even when both genders possess access to computers, men tend to wield an advantage over women regarding computer utilisation.

Moreover, the study reveals a notable discrepancy, with 82% of men and only 16% of women serving as the primary users of household computers (Venkatesh, 2000). Additional

investigations have highlighted that Information and Communication Technology (ICT) resources are accessible to a limited number of women, predominantly from the privileged urban segment with higher socio-economic status (Agarwal & Malhotra, 2016). The digital gender gap is also shaped by socio-cultural factors that carry significant weight. Within India, approximately 12% of women attribute their non-usage of the Internet to its unfavourable societal stigma, and 8% cite familial restrictions as a barrier to computer usage (Intel & Dalberg, 2012). Moreover, research indicates that gender bias can further compound caste-based discrimination, leading to even greater hurdles for women from lower castes and residing in rural areas in accessing and utilising ICT resources. These studies have shown that these women often face a dual burden of both gender and caste-based disadvantages, which can limit their opportunities for education, employment, and access to technology (Best and Maier, 2007; Singh et al., 2013; Rajam et al., 2021).

Disparities in educational attainment stand out as one of the most influential factors contributing to the digital divide among individuals. The extent to which people can access and effectively utilise digital technologies is closely intertwined with their level of education. Research by Van Dijk (2005) and Warschauer (2003) underlines how educational attainment is a crucial determinant of digital skills and internet usage patterns. Individuals with higher levels of education are more likely to possess the necessary cognitive and technological skills to navigate and engage with digital platforms. In the context of India, studies conducted by Asrani (2020) and Asrani and Kar (2022) have provided further evidence of the strong correlation between levels of education and access to, as well as the capacity to use, ICT tools. Individuals from higher castes and with higher levels of education are more likely to have access to formal education and resources that facilitate digital literacy. Higher education equips individuals with the cognitive abilities and critical thinking skills necessary to navigate and benefit from digital platforms effectively, which is not the case for individuals from lower castes.

Increased income improves the affordability of ICT devices, resulting in a higher likelihood of ownership among households with higher incomes (Nishijimaa et al., 2017; Asrani, 2020; Asrani & Kar, 2022). Marginalised castes often have limited access to ICT infrastructure, such as computers, smartphones, and the Internet. Conversely, households from lower-income backgrounds, often associated with marginalised castes, may face financial barriers to accessing ICT (Rajam et al., 2021).

Inclusive access to digital resources increases economic growth, and disparities in access to digital resources create significant socio-economic inequalities (Tewathia et al., 2020). The inequalities intensify if the level of digital literacy is also different in the different regions. The level of digital literacy depends on the location and income of the households. People from rural areas and poor income groups have lower access and know-how of digital resources than urban and rich households (Asrani, 2022). Considering the significant prevalence of poor and rural people, the access and know-how of digital literacy can create new levels of disparities in the economy (Tewathia et al., 2020). In the last decade, that is, in the 2010s, the government has given considerable focus on digitalising government services. Simultaneously, many new economic activities started, while many traditional activities disappeared due to digitalisation. Those who have access to and learned to use digital resources are better off than those who do not have access to digital resources in the present economic environment.

The access and know-how of digital resources vary for males and females across the rural and urban regions. A study by Islam and Manchanda (2023) reports that 51% of urban females have used the Internet at least once, whereas the figure is only 25% for rural females. They also argued that the usage of the Internet is decided not only by their ability to use it but by the availability of Internet facilities itself. The comparison of males and females for digital literacy further shows that females have lower access to digital literacy than males in rural and urban India (Singh, 2017). Although the access and know-how of digital literacy are low among females in India, the overall female labour force participation of India has been positively impacted by the expansion of the digitalisation of India (Islam & Manchanda, 2023). However, the benefits of digitalisation have mostly been enjoyed by the privileged sections of society (Oxfam India, 2022). For example, among the poorest households in India, only 2.7% have access to a computer, whereas the figure is 50.5% for the wealthiest 20% of households in India.

A study by Sharma and Banerjee (2022) identifies that access and know-how of digital resources are low among the marginalised groups in India. The lower access to digital resources is further limited to people with a working knowledge of English – most of the digital resources operate in this language only. It is already documented in the literature that access to the English language is the lowest among people in marginalised sections. The possession of mobile or computer devices strongly correlates with the education and income of the heads of

households in India (Agrawal & Asrani, 2018; Guha & Mukerji, 2021). Although lower-income families have less access to digital resources, many have greatly benefited from the ICT services. For instance, most of the knowledge about business, economy and society was earlier confined to educational institutions, big cities and rich houses. Due to the increased use of digital devices, especially mobile phones, computers, and the Internet, all kinds of information and knowledge are equally available to both rich and poor, lower and upper castes, and illiterates and postgraduates. Now, by using ICT services, people living in rural and remote areas and having different income levels can easily apply for college admissions, employment, government services, online learning certification, etc., from home.

While existing studies document caste, gender, income, and regional disparities in ICT access, most rely on narrow or self-reported measures of digital literacy. Limited attention has been paid to the intersectional disadvantages faced by marginalised groups, particularly women from lower castes in rural areas. Moreover, empirical evidence remains scarce on how structural barriers beyond education and income perpetuate digital exclusion in India.

Data Source

The study draws on unit-level data from the Multiple Indicator Survey (MIS), National Sample Survey (NSS) 78th Round, 2020–21, a nationally representative dataset covering 2,76,409 households (1,64,529 rural and 1,11,880 urban). In total, 11,63,416 individuals were enumerated (7,13,501 rural and 4,49,915 urban). For analytical precision, the paper restricts the sample to the working-age population (15–59 years), thereby excluding individuals below 15 and above 59 years. The analysis focuses on differences in computer literacy between Scheduled groups (Scheduled Castes and Scheduled Tribes) and non-Scheduled groups (Other Backwards Classes and General category).

The primary outcome variable, computer literacy, is constructed from nine competency-based questions asked of respondents. Each question was coded dichotomously (Yes = 1, No = 0), covering skills such as copying files, using spreadsheets, sending e-mails with attachments, installing software, and creating presentations. The responses were aggregated into a composite measure of digital proficiency, enabling systematic comparison across social groups.

Questions were as follows:

1. whether able to copy or move a file or folder

2. whether able to use the copy and paste tools to duplicate or move information within a document
3. whether able to send e-mails with attached files (e.g., documents, pictures, and videos)
4. whether able to use basic arithmetic formulae in a spreadsheet
5. whether able to connect and install new devices (e.g., modem, camera, printer)
6. whether able to find, download, install and configure software
7. whether able to create electronic presentations with presentation software (including text, images, sound, video, or charts)
8. whether able to transfer files between a computer and other devices
9. whether able to write a computer program using a specialised programming language

The nine questions were designed to assess respondents' ICT skills, which collectively form the study's outcome variable, computer literacy. An index was constructed by summing the responses, yielding scores ranging from 0 (no ICT skills demonstrated) to 9 (all skills demonstrated). To derive a dichotomous outcome, this index was categorised into two groups: individuals scoring ≤3 They were classified as digitally illiterate, while those scoring >3 were considered digitally literate. The threshold of three was chosen to ensure that respondents demonstrate proficiency in at least one-third of the ICT skills before being recognised as computer literate.

The study incorporates a wide range of independent variables capturing demographic, socio-economic, and infrastructural characteristics that influence computer literacy. Demographic variables include residence (rural or urban), sex (male or female), religion (Hindu, Muslim, Christian, and Others—where Others combines Sikhism, Buddhism, Zoroastrianism, and other minorities), and region (North, South, East, West, and North-East). Education is classified into four categories: illiterate, up to primary, above primary to higher secondary, and graduate and above. Employment status is distinguished between employed and unemployed, while access to a bank account is included as a measure of financial inclusion, recognising its potential correlation with digital literacy. Technological access is assessed through ownership of a mobile phone with an active SIM in the past three months, and household-level media access is measured by the availability of internet, newspapers, magazines, radio, or television. Finally, the type of educational institution is incorporated, distinguishing between government (including government-aided) and private (un-aided or unspecified). Together, these variables provide a multidimensional framework for analysing

how demographic background, economic resources, and infrastructural opportunities shape disparities in computer literacy across social groups. The detailed description and coding of the variables are provided in the Appendix, Table A1.

Empirical Methodology

Blinder (1973) and Oaxaca (1973) developed a linear regression decomposition approach to measure discrimination in the labour market between whites and blacks or white males and females. The mean difference in a result between the two groups is divided into "explained" and "unexplained" differences using the Oaxaca-Blinder decomposition. If we apply the same methodology to measure the extent of discrimination between non-SC/ST (non-scheduled) and SC/ST groups (scheduled) in having computer literacy, the equation can be written as (for SC/ST):

$$\ln \bar{Y}_{nscst} - \ln \bar{Y}_{scst} = \Sigma\hat{\beta}_{nscst} (\bar{X}_{nscst} - \bar{X}_{scst}) + \Sigma\bar{X}_{SC} (\hat{\beta}_{nscst} - \hat{\beta}_{scst}) \qquad (1)$$

The above equation suffers from the index number problem. To overcome this, Reimer (1983 and 1985), Cotton (1988), Neumark (1988), and Oaxaca and Ransom (1994) have come up with an improved decomposition technique, which is applied here to estimate the access of computer literacy coefficient to first estimate the advantage of being non-SC/ST household in accessing computer literacy vis-à-vis SC/ST households. The Oaxaca, Ransom and Cotton decomposition method can be mentioned as:

$$\ln \bar{Y}_{nscst} - \ln \bar{Y}_{scst} = \Sigma\beta^*(\bar{X}_{nscst} - \bar{X}_{scst}) + \Sigma\bar{X}_{nscst} (\hat{\beta}_{nscst} - \beta^*) + \Sigma\bar{X}_{scst} (\beta^* - \hat{\beta}_{scst}) \qquad (2)$$

However, we could not use the Oaxaca-Blinder method in our study as our outcome variable is a non-linear binary (0, 1). For our analysis, we have applied Fairlie decomposition (Fairlie, 2005), which is suitable in this case.

$$\bar{Y}_n - \bar{Y}_s = [(\bar{X}_n - \bar{X}_s)\hat{\beta}_n] + [\bar{X}_s(\hat{\beta}_n - \hat{\beta}_s)] \qquad (3)$$

The first term (in the bracket) denotes the explained difference (or the covariate effect) which exists due to endowment differences between SC/ST and non-SC/ST, whereas the second term in the bracket is due to unexplained or unmeasurable endowments (coefficient effect) between the two. This unexplained part is termed the “discrimination” between the scheduled and non-scheduled groups.

Results and Discussions

The analysis reveals that 84% of Indians remain digitally illiterate. Within the working-age population, computer literacy is markedly lower among Scheduled groups, with only 9.4% classified as digitally literate, compared to 19% among non-Scheduled groups—a twofold difference. Table 1 reports literacy levels across selected variables, consistently showing that the Scheduled groups lag their non-Scheduled counterparts. The gap is particularly pronounced in urban areas, where 28.5% of non-Scheduled individuals are computer literate, compared to just 17% among Scheduled groups, reflecting a disparity of more than ten percentage points.

Table 1. Computer Literacy between Scheduled and non-Scheduled Groups in India (15-59 Years)

Variable	Scheduled	Non-Scheduled
Residence		
Urban	16.8	28.5
Rural	4.1	8.1
Education		
Illiterate	0.03	0.02
Up to Primary	0.24	0.4
Above Primary to HS	10.26	14.1
Graduate and above	53.1	63.4
Sex		
Male	21.8	37.8
Female	4.1	10.6
Religion		
Others	9.1	19.3
Hindu	6.5	16.9
Muslim	5.4	7.8
Christian	14.0	42.0
Employment Status		
Unemployed	6.5	12.8
Employed	7.4	22.4
Mobile with SIM		
No	0.9	1.9
Yes	21.5	34.3
Shared	5.4	9.6
Mass Media Access		
No	0.4	0.8
Yes	9.4	18.6
Broadband Access		
No	0.2	0.3
Yes	19.0	29.1

Variable	Scheduled	Non-Scheduled
Institution Type		
Government	40.0	55.7
Private	6.2	15.2
Bank Account		
No	3.9	6.5
Yes	7.2	17.1
Region		
North	4.4	11.4
South	14.4	26.4
East	3.7	9.1
West	10.6	21.3
North-East	18.8	20.9

Source: Author's calculation based on NSSO-78th Round (2020–21).

Note: Household size, monthly per capita consumption expenditure (MPCE) and age are not added in the descriptive analysis as they are treated as continuous variables.

It is also evident and logical that computer literacy increases as the educational attainment of an individual increases, which holds true for both scheduled and non-scheduled groups. However, there are some interesting observations between these groups. Computer literacy is approximately the same for them as for the illiterate group of people. i.e., an illiterate person also lacks computer literacy irrespective of her caste. There is more than a percentage point difference in computer literacy between scheduled and non-scheduled individuals who have an education of graduate level or above.

Computer literacy among scheduled males is 22 per cent, whereas for non-scheduled it is 38 per cent (the difference is 16 per cent), whereas the difference for females between scheduled and non-scheduled is 6 per cent. If we compare computer literacy between males and females of the scheduled, the difference is approximately 18 per cent. Among all the religions in the country, scheduled and non-scheduled Christians have the highest percentage of computer literacy, 14 per cent and 42 per cent respectively. Employment does affect an individual's computer literacy in general. For the scheduled group, there is not much difference between the employed computer literate and the unemployed computer literate. However, this difference is more than 9 per cent for non-scheduled. There is a 15 per cent difference in computer literacy between employed scheduled and employed non-scheduled individuals.

Access to mobile phones (with SIM), broadband, and mass media also influences computer literacy among both Scheduled and non-Scheduled groups, though the effects differ across communities. When neither group owns a mobile phone with a SIM card, their literacy

levels are similar. However, among individuals with mobile access, computer literacy is substantially higher for the non-Scheduled group than for the Scheduled group. Broadband access further highlights the disparity: Scheduled Castes report 19% literacy, while the corresponding figure for non-Scheduled groups is 29%, a difference of 10 percentage points.

Regional variation is also evident. Southern and North-Eastern states outperform other regions, with more than one-quarter of non-Scheduled individuals in the South being computer literate, compared to 14% among Scheduled groups. By contrast, the North and East record the lowest literacy levels for both groups. Figure A (Appendix) illustrates this state-wise variation, with southern states reporting relatively high digital literacy and several northern and eastern states showing extremely low levels.

Table 2 presents the results of logistic regression analysis of computer literacy on the explanatory variables. Consistent with earlier work (Tewathia et al., 2020), caste emerges as a significant determinant of digital inequality. Among Scheduled groups, urban residents are more likely than rural residents to be computer literate. Educational attainment exerts a strong positive effect: compared to illiterate individuals, graduates and above have 6.07 times higher log-odds of being computer literate. Gender differences are also evident, with females showing lower odds of literacy than males, a finding aligned with previous studies (Bimber, 2000; Hargittai & Shafer, 2006; Singh et al., 2013; Martínez-Cantos, 2017).

Employment status matters as well. Employed Scheduled individuals are more likely to be computer literate, likely because earnings enable investment in ICT-related resources such as mobiles, broadband connections, or training. Mobile phone ownership itself significantly raises the probability of computer literacy, as does access to mass media (radio, television, internet, newspapers, or magazines). Broadband access is particularly influential: Scheduled individuals with broadband are 3.8 times more likely to be literate than those without, underscoring the centrality of internet connectivity. Regional patterns show that, relative to the North, Scheduled individuals in the South, West, and North-East have significantly higher odds of computer literacy. Age, however, has a negative effect—older individuals are less likely to acquire ICT skills. Finally, while household monthly per capita expenditure (MPCE) is positively associated with computer literacy, the effect size is modest, suggesting that income alone does not fully explain disparities in digital skills.

Table 2. Determinants of Computer Literacy: Logistic Regression

Variable	SC/ST Coefficients	SC/ST Standard Error	non-SC/ST Coefficients	non-SC/ST Standard Error
1. Residence (Ref: Rural)				
Urban	0.16***	0.04	0.20***	0.02
2. Education (Ref: Illiterate)				
Up to Primary	1.10***	0.41	2.04***	0.36
Above Primary to Higher Sec.	4.16***	0.38	4.98***	0.34
Graduate and above	6.07***	0.38	6.94***	0.34
3. Sex (Ref: Male)				
Female	−0.82***	0.04	−0.90***	0.02
4. Religion (Ref: Other)				
Hindu	−0.18**	0.07	−0.25***	0.06
Muslim	0.17	0.14	−0.33***	0.07
Christian	−0.07	0.09	0.18**	0.08
5. Employment Status (Ref: Unemployed)				
Employed	0.31***	0.04	0.46***	0.02
6. Mobile With SIM (Ref: No)				
Yes	1.12***	0.08	1.03***	0.04
Shared	0.65***	0.08	0.56***	0.04
7. Mass Media Access (Ref: No)				
Yes	0.38***	0.12	0.65***	0.09
8. Broadband Access (Ref: No)				
Yes	3.82***	0.09	4.11***	0.07
9. Institution Type (Ref: Govt.)				
Private	−0.99***	0.07	−1.00***	0.05
10. Bank Account (Ref: No)				
Yes	0.31***	0.07	0.39***	0.04
11. Region (Ref: North)				
South	0.70***	0.05	0.81***	0.02
East	−0.07	0.06	−0.01	0.03
West	0.39***	0.06	0.54***	0.03
North-East	0.85***	0.08	0.94***	0.08
12. Household Size	−0.12***	0.01	−0.11***	0.01
13. MPCE	0.0003***	0.00	0.0003***	0.00
14. Age	−0.07***	0.00	−0.08***	0.00
Constant	−7.36***	0.42	−8.34***	0.37
Log Likelihood	−10028.67		−36099.25	
Sample (N)	76,713		1,75,577	

Source: Author's calculation based on NSSO-78th Round (2020–21). MPCE = Households' monthly per capita expenditure.

Note: The dependent variable is computer literacy. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Non-scheduled group shows the same sign of relationship between the independent and outcome variable. However, the magnitude is different in comparison to the scheduled group. Non-scheduled urban individuals have higher odds of having computer literacy compared to the rural population. As the education level increases, the odds of individuals having computer literacy increase. For example, compared to the illiterate, those who have attained education up to graduation and above have a log odds of computer literacy of 6.9. Like scheduled females, females belonging to non-scheduled groups have lower odds of computer literacy compared to their male counterparts. Similarly, compared to the unemployed, employed non-scheduled individuals have higher odds of computer literacy (changes by 0.46). Mobile access positively affects computer literacy. Compared to those who don't have a mobile, individuals who have one have higher odds of computer literacy. Similarly, for mass media access, if a person has access to mass media, s/he have higher odds of computer literacy. Household size negatively affects computer literacy. The addition of a household member brings down the odds of computer literacy by 0.11. Similarly, with increasing age, computer literacy decreases. With an increase in age by one year, the log odds of computer literacy decrease by 0.08.

Table 3. Differences in Computer Literacy between SC/ST and non-SC/ST

Sl. No.	Covariates	Coefficient	Percentage of the total (%) covariates contribution
1	Residence	0.003***	4.2
2	Education	0.028***	44.1
3	Sex	0.0003***	0.6
4	Religion	−0.004***	−6.8
5	Employment Status	−0.001***	−2.1
6	Mobile with SIM	0.004***	5.6
7	Mass Media Access	0.002***	3.1
8	Broadband Access	0.027***	42.1
9	Institution Type	0.0003***	−0.5
10	Bank Account	0.0002***	0.5
11	Region	−0.001**	−2.0
12	Household Size	0.001***	0.8
13	MPCE	0.003***	4.5
14	Age	0.004***	5.9
	Total (=1 to 14)	0.063	100.0
Decomposition Analysis			
1	Total Explained Gap	0.063	85.6
2	Total Unexplained Gap	0.010	14.4
	Total Raw Differentials (=1+2)	0.073	100.0

Sl. No.	Covariates	Coefficient	Percentage of the total (%) covariates contribution
	Mean Prediction of non-SC/ST	0.17	
	Mean Prediction of SC/ST	0.096	
	Samples (N)	252, 290	

Source: Author's calculation based on NSSO-78th Round (2020–21).
Note: The dependent variable is computer literacy. *** p < 0.01; ** p < 0.05; * p < 0.1.

Table 3 shows the Fairlie decomposition analysis of the study. The result shows that, including all the variables in the study, 86 per cent of computer literacy is explained by them, which suggests that there are other important factors that impact computer literacy. Literature suggests (Blinder-Oaxaca, 1973; Fairlie, 2005) that this unexplained part is the discrimination coefficient between SC/ST and non-SC/ST. The result finds that this discrimination is 14 per cent. Each variable has a different endowment contribution to computer literacy between scheduled and non-scheduled. The highest difference in having computer literacy between SC/ST and non-SC/ST is explained by educational attainment. The gap between these two groups is 44%. Broadband access is the next disadvantage to SC/ST individuals, where 42% is the gap between the two groups in computer literacy. This indicates that non-SC/ST individuals have an advantage over SC/ST in terms of broadband access as an endowment benefiting the former. Availability of mobile (with SIM) is another factor that explains the gap in computer literacy between scheduled and non-scheduled groups, to the disadvantage of the SC/ST by 5.6%. Other factors also contribute to explaining the gap in computer literacy between scheduled and non-scheduled groups, which are statistically significant, but in terms of absolute value, they are small.

Conclusions and Policy Implications

A study finds that computer literacy is highly dependent on internet connection; the state should implement policies that aim at providing internet connection to individuals. Apart from increasing computer literacy in the country, it would enhance their capability in general, which would increase their employability in the market. In India, there are glaring disparities in computer and digital resource access, with marginalised communities, particularly the Scheduled Castes and Scheduled Tribes (SC/STs), facing significant hurdles. This inequity poses regressive challenges to India's economic development. In light of the increasing significance of digital education, our research delves into the extent of digital discrimination

experienced by these marginalised groups within the Indian economy. Leveraging extensive data from the NSS 78th Round (2020-21) Multiple Indicator Survey (MIS) targeting individuals aged 15-59, we explore various dimensions of computer literacy within this dataset. Our findings indicate that a substantial 84% of the Indian population lacks digital literacy. Notably, Scheduled groups exhibit a digital literacy rate of 9.4%, while non-Scheduled groups fare significantly better at 19%. Furthermore, the digital literacy gap between the Scheduled and non-Scheduled is significant. Among females, this disparity is relatively smaller, at 6%. To scrutinise this disparity, we employ Oaxaca and Ransom's (1994) improved decomposition technique to estimate the coefficient of computer literacy access. Our results suggest that, even after accounting for all the variables in the study, 86% of the disparity in computer literacy can be explained by these factors, hinting at the presence of other influential variables affecting computer literacy. The study further reveals that 14% of this discrimination remains unexplained. Notably, educational attainment emerges as the primary contributor to the gap in computer literacy between SC/ST and non-SC/ST individuals, accounting for a substantial 44%. This situation has the potential to exacerbate existing gender and caste inequalities and give rise to new forms of digital disparities in India. To address these issues, we recommend implementing community-level measures, including ensuring access to electricity and the internet in areas predominantly inhabited by marginalised groups, as part of an effort to enhance the social capital of these communities.

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References

Agarwal, R., & Malhotra, G. (2016). Women and access to ICT: A case study of India. African Journal of Business Management, 10(11), 288–297. https://doi.org/10.1080/09718524.2018.1496695

Agrawal, A., & Asrani, C. (2018). Digital divide among the Indian households: Extent and correlates. Economic Bulletin, 38(4).

Amiri, S., & Woodside, J. M. (2017). Emerging markets: The impact of ICT on the economy and society. Digital Policy, Regulation and Governance, 19(5), 383–396. https://doi.org/10.1108/DPRG-05-2017-0026

Antonio, A., & Tuffley, D. (2014). The gender digital divide in developing countries. Future Internet, 6(4), 673–687. https://doi.org/10.3390/fi6040673

Asrani, C. (2022). Spanning the digital divide in India: Barriers to ICT adoption and usage. Journal of Public Affairs, 22(4). https://doi.org/10.1002/pa.2598

Asrani, C., & Kar, A. K. (2022). Diffusion and adoption of digital communications services in India. Information Technology for Development, 28(3), 488–510. https://doi.org/10.1080/02681102.2021.1934829

Bala, S., & Singhal, P. (2018). Gender digital divide in India: A case of inter-regional analysis of Uttar Pradesh. Journal of Information, Communication and Ethics in Society, 16(2), 173–192. https://doi.org/10.1108/JICES-01-2018-0001

Basak, G. (2024). Digital transformation of 21st education sector in India. EPRA International Journal of Research and Development (IJRD), 9(3), 326–334. https://doi.org/10.36713/epra2016

Best, M. L., & Maier, S. (2007). Gender, culture and ICT use in rural south India. Gender, Technology and Development, 11(2), 137–155. https://doi.org/10.1177/097185240601100201

Bimber, B. (2000). Measuring the gender gap on the internet. Social Science Quarterly, 81(3), 868–876.

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. Journal of Human Resources, 8(4), 436–455. https://doi.org/10.2307/144855

Brussevich, M., Dabla-Norris, E., Kamunge, C., Karnane, P., Khalid, S., & Kochhar, K. (2018). Gender, technology, and the future of work. IMF Staff Discussion Notes, 2018(07), 1. https://doi.org/10.5089/9781484379769.006

Chakradhar, J., & Choudhary, P. K. (2024). Inequalities in computer literacy in India. Economic and Political Weekly, 59(31), 5.

Cotton, C. J. (1988). On the decomposition of wage differentials. Review of Economics and Statistics, 70(2), 236–243. https://doi.org/10.2307/1928307

Dev, S. M. (2018). Labour market inequalities in India: Dimensions and policies. Indian Journal of Human Development, 12(2), 217–235. https://doi.org/10.1177/0973703020180205

dos Santos, I. C., de Araújo Leão, N. C., da Silva, E. E., & Silveira, G. B. (2022). Determinants of e-inclusion and digital inequality in the use of urban mobility applications in mobility. Research, Society and Development, 11(13), e184111335243. https://doi.org/10.33448/rsd-v11i13.35243

Fairlie, R. W. (2005). An extension of the Blinder-Oaxaca decomposition technique to logit and probit models. Journal of Economic and Social Measurement, 30(4), 305–316. https://doi.org/10.3233/JEM-2005-0232

Guha, A., & Mukerji, M. (2021). Determinants of digital divide using demand-supply framework: Evidence from India. Australasian Journal of Information Systems, 25. https://doi.org/10.3127/ajis.v25i0.3029

Haenssgen, M. J. (2018). The struggle for digital inclusion: Phones, healthcare, and marginalisation in rural India. World Development, 104, 358–374. https://doi.org/10.1016/j.worlddev.2017.12.024

Hannemann, N., Götz, N. A., Schmidt, L., Hübner, U., & Babitsch, B. (2021). Perception of a tracing app during the COVID-19 pandemic in Germany. In Public Health and Informatics (pp. 816–817). IOS Press. https://doi.org/10.3233/SHTI210266

Hargittai, E., & Shafer, S. (2006). Differences in actual and perceived online skills: The role of gender. Social Science Quarterly, 87(2), 432–448. https://doi.org/10.1111/j.1540-6237.2006.00389.x

Hilbert, M. (2011). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. Women's Studies International Forum, 34(6), 479–489. https://doi.org/10.1016/j.wsif.2011.07.001

Intel, & Dalberg. (2012). Bridging the Internet gap and creating new global opportunities in low and middle-income countries. SME Finance Forum. https://www.smefinanceforum.org/post/women-and-the-web-bridging-the-internet-gap-and-creating-new-global-opportunities-in-low-and

Islam, A., & Manchanda, P. (2023). Gender inequalities in Digital India: A survey on digital literacy, access, and use. Digital Futures at Work Research Centre (Digit). https://doi.org/10.20919/MCUU2363

Jin, S., & Cho, C. M. (2015). Is ICT a new essential for national economic growth in an information society? Government Information Quarterly, 32(3), 253–260. https://doi.org/10.1016/j.giq.2015.05.006

Majumdar, K., Nambiar, M., Ranjan, P., Kumar, S., & Kumari, D. (2024, April 29). Historical inequalities and the unequal access to digital communications. LSE Geography & Environment Blog. https://www.lse.ac.uk/geography-and-environment/research/social-media-and-crisis-of-urban-inequality-blog/historical-inequalities-and-unequal-access-to-digital-communications

Malik, S., & Akhtar, N. (2022, June). Digital divide and the Scheduled Tribes in India: Extent, consequences, and challenges (Discussion Paper). Social and Political Research Foundation. https://sprf.in/wp-content/uploads/2024/12/SPRF-2022_DP_Digital-Divide-and-ST.pdf

Martínez-Cantos, J. L. (2017). Digital skills gaps: A pending subject for gender digital inclusion in the European Union. European Journal of Communication, 32(5), 419– 438. https://doi.org/10.1177/0267323117718464

Mayell, H. (2003, June 2). India's "untouchables" face violence, discrimination. National Geographic. https://www.nationalgeographic.com/pages/article/indias-untouchables-face-violence-discrimination

Mishra, V. K. (2023). Caste and religion matters in access to housing, drinking water, and toilets. CASTE: A Global Journal on Social Exclusion, 4(1), 24–45. https://doi.org/10.26812/caste.v4i1.398

Moreno, R. M., Borrero, M. F., Ferri Fuentevilla, E., Medina, F. R., Luchena, A. M., & Aguado, O. V. (2023). Technologies and social services: An overview of technology use by users of social services. PLOS ONE, 18(5), e0284966. https://doi.org/10.1371/journal.pone.0284966

Morrisson, C., & Jütting, J. P. (2005). Women's discrimination in developing countries: A new data set for better policies. World Development, 33(7), 1065–1081. https://doi.org/10.1016/j.worlddev.2005.04.002

Mosse, D. (2018). Caste and development: Contemporary perspectives on a structure of discrimination and advantage. World Development, 110, 422–436. https://doi.org/10.1016/j.worlddev.2018.06.003

Neumark, D. (1988). Employers' discriminatory behaviour and the estimation of wage discrimination. Journal of Human Resources, 23(3), 279–295. https://doi.org/10.2307/145830

Nishijima, M., Ivanauskas, T. M., & Sarti, F. M. (2017). Evolution and determinants of digital divide in Brazil (2005–2013). Telecommunications Policy, 41(1), 12–24. https://doi.org/10.1016/j.telpol.2016.10.004

OECD. (2001). Understanding the digital divide. OECD Digital Economy Papers, No. 49. OECD Publishing. https://doi.org/10.1787/236405667766

Oxfam India. (2022). Digital divide: India inequality report 2022. Oxfam India. https://www.oxfamindia.org

Oaxaca, R. (1973). Male-female wage differentials in urban labour markets. International Economic Review, 14(3), 693–709. https://doi.org/10.2307/2525981

Oaxaca, R. L., & Ransom, M. R. (1994). On discrimination and the decomposition of wage differentials. Journal of Econometrics, 61(1), 5–21. https://doi.org/10.1016/0304-4076(94)90074-4

Padhy, A., & Panbude, S. (2025, June 13). The digital wall: How caste shapes access to technology in India. India Development Review. https://idronline.org/article/inequality/the-digital-wall-how-caste-shapes-access-to-technology-in-india/

Pankaj, A. K. (2019). Caste and discrimination in welfare: Social exclusion of Dalits in Uttar Pradesh. Contemporary Voice of Dalit, 11(2), 139–149. https://doi.org/10.1177/2455328X19860066

Pushpanadham, K. (2019). Massive open online courses: The emerging landscape of digital learning in India. IIEP Foresight Papers. UNESCO. https://www.iiep.unesco.org

Rajam, V., Reddy, A. B., & Banerjee, S. (2021). Explaining caste-based digital divide in India. Telematics and Informatics, 65, 101719. https://doi.org/10.1016/j.tele.2021.101719

Reimer, C. W. (1983). Labour market discrimination against Hispanic and black men. Review of Economics and Statistics, 65(4), 570–579. https://doi.org/10.2307/1924167

Saravana, K., & Kumar, D. (2022, December 31). Digital exclusion and caste in India: A meta-analytical study. The Social Science Dialogue. https://www.thesocialsciencedialogue.com/post/digital-exclusion-and-caste-in-india-a-meta-analytical-study

Sharma, A., & Banerjee, A. (2022). Socio-economic determinants of digital divide in India. Demography India, 51(1).

Singh, D. (2025). Dalits' encounters with casteism on social media: A thematic analysis. Information, Communication & Society, 28(2), 335–353. https://doi.org/10.1080/1369118X.2025.2462244

Singh, N., Zhou, Y., Williams, K., Kendall, J., & Kaushik, P. D. (2013). Bridging the digital divide in rural India: Lessons from a survey in four states. Review of Market Integration, 5(1), 1–42. https://doi.org/10.1177/0974929213481776

Singh, S. (2010). Digital divide in India: Measurement, determinants and policy for addressing the challenges in bridging the digital divide. International Journal of Innovation in the Digital Economy, 1(2), 1–24. https://doi.org/10.4018/jide.2010040101

Singh, S. (2017). Bridging the gender digital divide in developing countries. Journal of Children and Media, 11(2), 245–247. https://doi.org/10.1080/17482798.2017.1305604

Starr, K. J., & Sahgal, N. (2021, June 29). Measuring caste in India. Pew Research Center. https://www.pewresearch.org/decoded/2021/06/29/measuring-caste-in-india/

Tewathia, N., Kamath, A., & Ilavarasan, P. V. (2020). Social inequalities, fundamental inequities, and recurring of the digital divide: Insights from India. Technology in Society, 61, 101251. https://doi.org/10.1016/j.techsoc.2020.101251

Tiwari, C., Goli, S., Siddiqui, M. Z., & Salve, P. S. (2022). Poverty, wealth inequality and financial inclusion among castes in Hindu and Muslim communities in Uttar Pradesh, India. Journal of International Development, 34(6), 1227–1255. https://doi.org/10.1002/jid.3626

Vaidehi, R., Reddy, A. B., & Banerjee, S. (2021, June 30). Explaining caste-based digital divide in India [Preprint]. arXiv. https://arxiv.org/abs/2106.15917

Van Dijk, J. A. G. M. (2005). The deepening divide: Inequality in the information society. Sage.

Warschauer, M. (2003). Dissecting the digital divide: A case study in Egypt. The Information Society, 19(4), 297–304. https://doi.org/10.1080/01972240309490

Weiss, D., Rydland, H. T., Øversveen, E., Jensen, M. R., Solhaug, S., & Krokstad, S. (2018). Innovative technologies and social inequalities in health: A scoping review of the literature. PLOS ONE, 13(4), e0195447. https://doi.org/10.1371/journal.pone.0195447

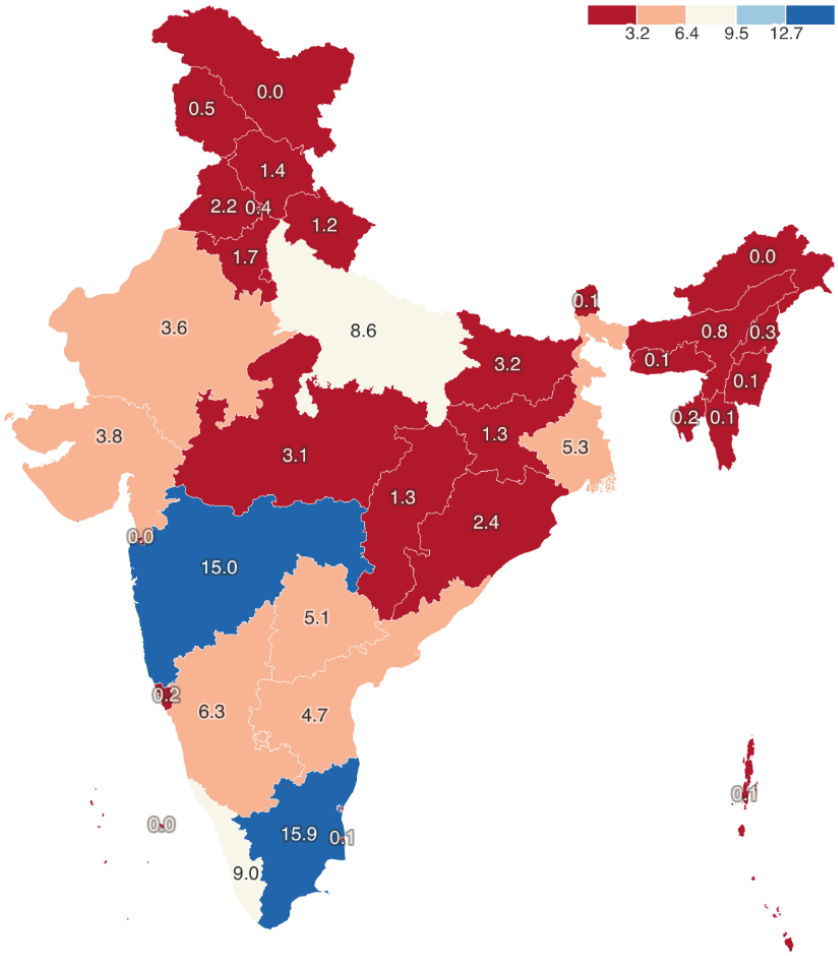
Appendix

Table A1. Description of Dependent and Independent Variables

Variable	Category	Coding
Panel A: Dependent Variable		
Digital Literacy		0 if digitally illiterate and 1 if literate
Panel B: Independent Variables		
Residence	Rural	1 if rural and 0 if urban
	Urban	1 if urban and 0 if rural
Education	Illiterate	1 if illiterate and 0 otherwise
	Up to primary	1 if up to primary 0 otherwise
	Above primary to HS	1 if above primary to HS 0 otherwise
	Graduate and above	1 if graduate and above 0 otherwise
Sex	Male	1 if male and 0 if female
	Female	1 if female and 0 male
Religion	Others	1 if other religion, 0 otherwise
	Hindu	1 if Hindu, 0 otherwise
	Muslim	1 if Muslim, 0 otherwise
	Christian	1 if Christian, 0 otherwise
Employment Status	Unemployed	1 if unemployed, 0 otherwise
	Employed	1 if employed, 0 otherwise
Mobile with SIM	No	1 if no mobile with SIM, 0 otherwise
	Yes	1 if one has mobile with SIM, 0 otherwise
	Shared	
Mass Media Access	No	1 if there is no media access, 0 otherwise

Variable	Category	Coding
	Yes	1 if there is media access, 0 otherwise
Broadband Access	No	1 if there is no broadband access, 0 otherwise
	Yes	1 if there is broadband access, 0 otherwise
Institution Type	No	1 if enrolled in government institute, else 0
	Yes	1 if enrolled in private institute, 0 otherwise
Bank Account	No	1 if there is no bank account, 0 otherwise
	Yes	1 if there is bank account, 0 otherwise
Region	North	1 if one belongs to north, 0 otherwise
	South	1 if one belongs to south, 0 otherwise
	East	1 if one belongs to east, 0 otherwise
	West	1 if one belongs to west, 0 otherwise
	North-East	1 if one belongs to north-east, 0 otherwise

Figure A: Digital Literacy in states and UTs in India (2020-21)



Source: Multiple Indicator Survey in India, NSS 78th Round, 2020-2021