

The Changing Face of Digital Inequality: Gender, Adolescents, and Technology in Post-COVID Delhi

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Abstract

The present study looks at digital access among students of secondary education in Delhi through a gendered lens. This study focuses on the adolescent group and gazes at the involvement of technological resources in their lives. This quantitative study also looks at how these adolescents perceive their parents' attitudes towards the usage of digital resources. The present study adds to the scholarship on the adolescent population and their interaction with technology in gender studies on such population-specific studies on Delhi in particular. The study highlights that within Delhi digital gaps between the adolescent populations seem to have narrowed. However, the gap now appears only in terms of high-end expensive technology distribution between the two genders. The research adds to the vast literature that presents positive growth stories related to gender development.

Keywords: Adolescents, Digital access, Parental attitude, Technology, Gender, Digital Divide

1. Introduction

The gendered digital divide is a recognized global issue, with studies showing women's comparatively lower engagement with technology. In 2017, 56% of global internet users were men, compared to 44% women (Bhattacharya, 2017). In South Asia, the mobile gender gap widened slightly from 27% in 2017 to 28% in 2018 (Rowntree, 2019), with men's internet access approximately 80.2% higher than women's in low-income countries (Hilbert, 2011). These figures highlight that digital literacy involves more than access; disparities also exist in usage and efficiency (Women's Rights Online, 2015). However, some research suggests a more nuanced picture where women's enrollment in IT degree programs has occasionally equaled or surpassed men's (Mellström, 2009). In India IT employment is often viewed as suitable for women, given its office-based nature (Gupta, 2017). Despite this, significant gaps in mobile and internet use persist: only 16% of Indian women use mobile and internet services (India's on a digital sprint, 2019), with mobile phone usage at 71% among men versus 38% among women (Shah, 2018). This divide becomes especially stark during adolescence, widening with age and marriage (Rowntree, 2019; Shah, 2018).

Studies on adolescents show similar patterns. For instance, boys aged 14-18 are 10% more likely to have used a phone than girls (Pratham, 2017). Some Delhi-based research suggests higher smartphone usage by females (Taywade, 2019), particularly for social networking and entertainment apps, though other studies emphasize lower access for girls overall (Kumar & Gupta, 2016; Balachandran, 2020). The COVID-19 pandemic accelerated digitalization in education, with nearly 320 million learners affected in India alone (Jena, 2020). Although it

spurred technological adoption (Iivari, 2020), it also intensified existing inequalities, particularly between government and private schools in Delhi-NCR (Jain, 2020), and between urban and rural learners (India's on a digital sprint, 2019). COVID-19 further widened gender gaps, disrupting education for 158 million girl students (Gogoi, 2021) and reducing girls' access to home phones and digital devices (Balachandran, 2020).

Globally, digital literacy remains skewed. Only 29% of internet users in India are women, with rural cultural restrictions further exacerbating access issues (Bhattacharya, 2017; Dutta, 2019). Mobile phone ownership often represents a critical step toward freedom and agency for women (Dutta, 2019), reinforcing the importance of safeguarding digital spaces to promote gender inclusivity (Rivoltella, 2008). In education, gender disparities persist despite efforts like India's National Education Policy (NEP) 2020, which proposes a Gender-Inclusion Fund and initiatives to promote digital learning (NEP, 2020). However, concerns remain about effective implementation and whether access to resources truly translates into education rather than merely school attendance. Structural inequalities in STEM and digital fields continue to limit young women's participation (UNESCO, 2019). Building on this context, the following section outlines the specific research questions that guide the present study's investigation into the gendered digital divide among adolescents in Delhi-NCR.

2. Research Methods and Design:

2.1 Research question:

This study investigates the gendered digital divide among adolescents in urban Delhi, a significant issue in today's increasingly digital society. It explores the existence and nature of gendered digital experiences among these adolescents, examining their impact on life choices and the influence of sociocultural factors. The COVID-19 pandemic, with its shift from physical to virtual learning, has significantly impacted adolescent learning experiences globally. As education relies more on advanced technology, new media, and associated techno-cultural practices reshape how we learn and function in society. This study aims to understand the social factors influencing the distribution and access of digital technologies among adolescent secondary school students, specifically focusing on the role of gender.

The study seeks to answer the following research questions:

1. To what extent does access to digital technology explain the different ways adolescent boys and girls use it?
2. How did COVID-19 affect the gendered digital divide among adolescent boys and girls, either by narrowing or widening it?

2.2. Research Methodology

2.2.1 Overview of study design:

This quantitative study investigated digital access and performance among secondary school students using a comprehensive questionnaire. The questionnaire included categorical, ordinal, and numerical variables, and the data was analyzed using SPSS. The study focused on three key independent variables: gender, income group, and school type, using these as the basis for evaluating digital access and performance among the students. The questionnaire underwent multiple reviews before being finalized and distributed to students via Google Forms. To ensure ethical data collection, a consent form outlining the research project was included with each distributed form.

2.2.2 Questionnaire overview:

The questionnaire used 13 binary ("Yes/No") questions. Four assessed access to specific technologies (e.g., smartphone ownership), while the remaining nine gauged the ability to perform basic digital tasks (e.g., computer/laptop use, time spent on a computer). Two additional questions used time intervals to measure the duration of computer use (less than or more than five years) and time spent in online classes using digital tools (less than or more than five hours).

2.2.3 Sampling Method:

Due to lockdown restrictions, data was collected using two non-probability sampling methods: convenience and snowball sampling. Convenience sampling was deemed most appropriate under the circumstances, as it allows researchers to utilize readily available respondents, especially when a sampling frame is unavailable (Jupp, 2006). This approach facilitated timely data collection and avoided complex procedures. To achieve the desired sample size, snowball sampling was also employed, with participants contacted via phone and WhatsApp and asked to forward the survey to others. A brief research introduction and an ethical consent form accompanied the survey to ensure ethical data collection.

2.2.4 Participant Demography:

The 178 participants were 9th and 10th-grade students from the Delhi NCR region, with a mean age of 14.65 (range: 12-17). The mean age was nearly identical for female (14.64) and male (14.69) students. The sample consisted of 112 males and 66 females. A large majority (145, 81.5%) attended government schools, compared to 33 (18.5%) from private schools, reflecting the non-proportional sampling method used. There were 102 (57.3%) 10th graders and 76 (42.7%) 9th graders. The social category breakdown was: 111 (68.1%) General, 31 (19.0%) OBC, 18 (11.0%) SC, and 3 (1.9%) ST. Fifteen participants did not report their social category (n=163 for this variable). Regarding annual family income, 128 (70.9%) reported incomes below

₹2 lakh, while 50 reported incomes above this threshold. Data collection occurred between June 3, 2021, and August 12, 2021, taking approximately two months and nine days.

2.2.5 Missing Values:

Of the 197 questionnaires collected, 14 were entirely blank and excluded from the analysis. The remaining 183 responses formed the initial dataset. However, due to several responses containing 4-5 missing values, the final analysis primarily used a dataset of 178-179 responses to ensure data integrity. The sample size (n) therefore varies between 178 and 179 participants, though it is explicitly noted when the sample size is larger or smaller. In some cases with numerous missing values, the sample size was as low as 132.

3. Data Analysis and Findings

3.1 Digital Access and Gender

To investigate the potential relationship between gender and smartphone ownership, a chi-square test for independence was conducted. The results of this test revealed that smartphone ownership was not found to be statistically associated with gender. Within the study sample of 179 students, only 81 students reported owning a smartphone; of these, 34 were female and 46 were male. Due to one missing response regarding smartphone ownership, the sample size for this specific analysis was n=178. Despite the lack of statistical significance, a comparison of the percentage of smartphone owners within each gender group showed that 51.5% of female students possessed personal smartphones, compared to 41.1% of male students.

Furthermore, the relationship between smartphone ownership, both before and after the onset of the COVID-19 pandemic, and gender was also examined using a chi-square test of independence. This analysis similarly revealed no statistically significant relationship between these variables. However, the data indicated that a higher percentage of female students (77.8%) acquired their smartphones after the beginning of the COVID-19 pandemic, while the corresponding percentage for male students was 66.7%. Another aspect of digital access considered was access to Wi-Fi. A chi-square test for independence was employed to determine if Wi-Fi access was related to student gender. The results of this test indicated that these two factors were not significantly related. A percentage comparison of male and female students reporting Wi-Fi access showed that 43.8% of male students had access to Wi-Fi, compared to 37.8% of female students.

Similarly, ownership of 4G phones did not demonstrate any significant relationship with student gender. The analysis also found no significant relationship between gender and the usage of computers for learning purposes. The percentage of male (74.2%) and female (71.2%) students who used computers for learning purposes was nearly identical. Another parameter explored to assess the potential influence of gender on digital access was the frequency with which students

experienced connectivity issues. The chi-square test for independence conducted on this data revealed no significant relationship between connectivity issues and student gender. An independent samples t-test was also performed to examine the relationship between mobile phone memory distribution and gender. The results of this test indicated that these two factors were not significantly related.

However, a statistically significant relationship was identified between computer processor distribution and student gender using a chi-square test of independence. Of the total 179 students, only 153 provided responses regarding the type of computer processors they had. The results of the chi-square test for independence, $\chi^2(1, N=154) = 11.36, p = .023$, demonstrate that computer processor distribution is dependent on gender. The results also indicate that in terms of percentages, female students (89.8%) were significantly more likely to report a lack of knowledge about computer processor types compared to male students (67.0%). The table below provides a detailed breakdown of the gender-wise percentage of students based on their reported processor information.

Table E

Which processor does your computer support? * Gender Cross tabulation					
			Gender		Total
			Female	Male	
Which processor does your computer support?	Don't know	Count	53	63	116
		% within Gender	89.8%	67.0%	75.8%
	Pentium Based	Count	0	6	6
		% within Gender	0.0%	6.4%	3.9%
	i3	Count	2	10	12

		% within Gender	3.4%	10.6%	7.8%
	i5	Count	3	13	16
		% within Gender	5.1%	13.8%	10.5%
	i7	Count	1	2	3
		% within Gender	1.7%	2.1%	2.0%
	Total		Count	59	94
% within Gender			100.0%	100.0%	100.0%

3.2 Perceived Parental Attitude and Digital Freedom:

To understand the influence of perceived parental attitudes on students' digital freedom, participants were asked to report their parents' attitudes toward their use of digital devices for a variety of activities, including education, shopping, banking, and entertainment. Student responses were collected using a four-point Likert scale, where a score of 1 represented "not supportive" and a score of 4 indicated "very supportive." An independent samples t-test was conducted to compare the mean scores of female and male students regarding these perceived parental attitudes. The analysis revealed a statistically significant difference between the mean scores of female and male students. Specifically, the mean score for female students ($M = 10.27$, $SD = 2.97$) was significantly higher than the mean score for male students ($M = 9.2$, $SD = 2.62$), $t(13) = 2.1$, $p = .034$. These findings suggest that female students perceived their parents' attitudes towards their digital device usage to be more supportive compared to the perceptions reported by male students.

4. Discussion

The indicators selected to assess digital access among participants revealed that none, except computer processor distribution, were significantly associated with student gender. Interestingly, females in the sample owned smartphones at a rate 10% higher than males, and more girls reported receiving smartphones after the onset of COVID-19. This finding contrasts with several national-level studies that highlight a crisis in adolescent girls' access to digital devices in India (Shah, 2018; Jain, 2020; Gogoi, 2021). However, it is important to recognize that these studies primarily focus on national trends and do not necessarily capture region-specific variations within Delhi's adolescent population. While national data show that only 38% of women in India own mobile phones compared to 71% of men (Sanghera, 2018), ownership patterns vary considerably across socio-economic groups and states.

In Delhi, smartphone penetration is expectedly higher. According to a McKinsey study, Delhi scored 0.67 on a smartphone distribution scale (where 0.2 indicates high inequality and 0.8 the lowest inequality), placing it among regions with relatively low gender divides, alongside Kerala, Goa, Sikkim, Himachal Pradesh, and Chandigarh (Woetzel et al., 2018). Reports show that by 2014, Delhi's total smartphone tally had reached 4.3 crores, implying that, on average, each individual owned two smartphones (Hindustantimes.com, 2010; bgr.in, 2014). These factors likely explain why female adolescents in Delhi exhibit better smartphone access than the national average. Additionally, falling smartphone prices which is a major barrier previously cited for women's lower ownership rates, have helped close this gap (Woetzel et al., 2018). Some reports even suggest that the gender digital divide in smartphone ownership has effectively closed in Delhi (Manzar, Kazi, Manoranjini, & Nair, 2023) (Samudra, 2022).

Another significant contributor to this trend is the rapid digitalization of education during the COVID-19 pandemic. As educational systems moved online, smartphones became essential tools for learning, especially for those who previously lacked digital access. The present study's findings that many girls acquired smartphones post-pandemic reflect how COVID-19 may have narrowed gender gaps in device access. However, it remains critical to recognize that this increase likely reflects necessity-driven ownership for educational purposes and may not translate into full digital autonomy for girls (Dutta, 2020).

In terms of Wi-Fi access and 4G phone ownership, female students trailed male students by five percentage points. Previous research has suggested that the gender gap in connectivity diminishes with higher education levels; for instance, only a 6% gap exists among individuals with tertiary education, compared to a 35% gap at the secondary level and a 100% gap at the primary education level (Women's Rights Online, 2015). Socio-cultural barriers also play a role: a New Delhi survey found that 60% of men believed men should have priority over women in internet access (Woetzel et al., 2018). Societal anxieties about online spaces being unsafe for girls often lead families to limit daughters' digital experiences, further restricting their familiarity with a broader range of digital tools beyond mobile phones.

The study also examined indicators previously overlooked in Delhi-based adolescent studies, specifically, mobile phone memory distribution and computer processor ownership. While no significant gender differences emerged for mobile memory, notable patterns were observed. For instance, 10.9% of female students owned high-memory (8GB/256GB) smartphones compared to just 2% of male students. Meanwhile, in lower memory categories, distributions between genders were more even. Previous research has identified limited phone memory, small screens, and background SMS interruptions as barriers to mobile learning (Hilao & Wichadee, 2017), suggesting that device specifications matter for digital learning outcomes.

In contrast, male students had better access to high-end computer processors. The gender gap in computer usage aligns with broader patterns identified in earlier studies, where males are more likely to use computers and laptops extensively (Chen & Boulianne, 2018). The finding that females were 8.2% less likely to have used computers for more than five years further illustrates persistent inequalities in access to advanced digital tools.

Finally, the study found that female students reported significantly higher perceived parental support for digital device usage compared to male students, a novel insight in the Delhi context. This finding is particularly noteworthy given earlier research indicating restrictive male attitudes toward women's internet usage in New Delhi, where over half the men surveyed felt women's internet access should be restricted (Wojnar & Agiwal, 2023). The present study suggests a possible shift toward more supportive attitudes for adolescent girls, at least regarding digital learning purposes.

5. Limitations:

A significant limitation of the study is the use of random indicators to assess students' access and performance, rather than employing a well-defined digital access and performance scale. This approach was adopted because no standardized scale for digital competence and access exists for the Indian context, particularly for the adolescent population. Another limitation concerns the assessment of parental attitudes. Perceived attitudes do not necessarily reflect actual attitudes, and thus, the findings of this study should be validated through an objective examination of parents' attitudes toward boys and girls. Additionally, the sampling technique used in the study presents a limitation. Rather than relying on snowball and convenience sampling, a more rigorous approach using proportionate and random sampling could have been employed.

6. Conclusion:

This study examined digital access among adolescent students in secondary schools in Delhi through a gendered lens, with a focus on how boys and girls perceive their parents' attitudes toward the use of digital devices for various purposes. The findings revealed that adolescent girls in Delhi's secondary schools are performing nearly on par with boys in some digital access indicators, though they fall behind in access to high-end technologies like computers. For example, the study found that boys typically own more powerful computer processors than girls and are more knowledgeable about these processors. In light of this, the research suggests that

financial and technical support should be provided to female students to ensure they can afford, access, and effectively use high-cost technological tools. As reports on India's digitalization have noted, the country's leading digital empowerment initiatives must be assessed through a gendered lens, and a clear strategy with specific goals for advancing women's empowerment must be developed. By reducing technology costs and targeting underserved populations, as various studies have suggested, the gender digital divide can be narrowed, as evidenced by the closing of the mobile phone gap in Delhi. The study also highlighted that female adolescents perceive their parents as more supportive than their male counterparts, a finding that may reflect a shift in attitudes toward girls' education, particularly regarding parents' willingness to make digital resources available to girls.

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Ethical Approval and Informed Consent statement: This study, involves adolescent participants aged 12-17 years. I received ethical approval from the Internal Ethics Committee, Department of Humanities and Social Sciences, BITS Pilani Goa. Written informed consent was obtained from all participants, their parents, and school authorities before any data was collected. Participant confidentiality and anonymity were maintained throughout the study, and no questions were included that could potentially cause psychological harm.

Data Availability: The datasets generated and analysed during the current study are available on request.

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