Sophistication with Limitation: Understanding Smartphone Usage by Emergent Users in India

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ABSTRACT

India has been witnessing a steady increase in smartphone penetration since 2016 after Reliance Jio introduced inexpensive internet plans. Much of HCI research in the Global South has been conducted before smartphones became more widespread. More recent work on smartphone use in India has been either domain-focused or studied specific features. In this work, we investigate how emergent users from low-income communities in India currently use their smartphones, and what they use them for. We draw on semi-structured interviews with emergent smartphone users across rural and urban India demonstrating their experiences and challenges related to low- textual and digital literacy, infrastructure, privacy, and motivations of use. Our findings revealed that while there is a lack of understanding of basic features such as accounts and passwords, there is sophisticated use spanning user-generated media, remote education, skilling, etc. We close with recommendations for future research and design for emergent smartphone users.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Empirical studies in HCI**; **Field studies**.

KEYWORDS

smartphone, emergent users, smartphone usage, app usage, low-income communities, next billion users, India, Global South

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1 INTRODUCTION

Smartphone internet penetration has been on the rise in India in recent years [26]. In 2016, telecommunications company Reliance Jio introduced affordable 4G data plans that provided users with free internet for the first nine months [21]. Since then, India has seen a significant reduction in the cost of smartphones and internet, which is also being termed the "Jio effect". India now has among the most affordable data plans in the world, at USD 0.21/GB [24]. Increasingly there have been more and more smartphones with internet among low-income communities. As per reports, the number of active rural internet users in India has gone up by 13% over the last year [25]. More than 227 million active internet users out of a total of 504 million active internet users in the country live in rural areas [27]. The majority of these users access internet using a mobile device as their primary medium [27]. There have been recent reports about the increasing popularity of media applications such as TikTok (now banned) and Sharechat, especially in smaller cities and rural areas in India [66].

With the increase in affordability and penetration of internet-enabled smartphones among low-income groups in India, there has been an increased interest in both academia and industry to design for new smartphone internet users, referred to as "emergent users" and the "next billion users" [6, 20, 73]. Several non-profit institutes such as AI4Bharat [3] and Wadhwani AI [2] have been building AI-based solutions to positively impact the lives of those at the bottom of the pyramid. Balkrishan and Joshi [6] define emergent users as, *"new users, who may have less education, who may be poor, who are often located away from commercial and political centers and are culturally different from not only the traditional (that is, urban and educated) users but from each other as well."* Research looking at smartphone usage of low-income populations in rural and urban India is still emerging.

A few recent studies have explored the usage of smartphones by emergent users in specific contexts such as education [78] and health [81], while other studies have examined the usage of specific apps or features through a usability lens (for e.g., WhatsApp) [6, 75]. Zamora's recent study looked at how new internet users in India and Brazil tried a lite smartphone for a month on an Android Go device that was given to them for the purpose of the study [86]. Ismail and Kumar in their recent work looked at the mobile, internet, and social media practices of women community health (ASHA) workers in India, for whom internet access became recently

possible after the launch of Reliance Jio [28]. We extend this rich but limited body of work with a detailed account of smartphone use by emergent users, both women and men, from low-income communities across rural and urban areas in India. Specifically, we focus on their everyday smartphone usage, experiences, and challenges. With easy access to smartphones, affordable data plans and rise in popularity of various media applications, it is important to understand how smartphones are being used by emergent users from low-income populations in rural and urban India to foster better research, design, and development of technologies catering to these users. In addition, identifying the challenges and opportunities of designing technologies for emergent users can help developers create more accessible interfaces.

In this paper we present findings from a qualitative study of smartphone adoption and usage among low-income communities in rural and urban India. We conducted 30 in-depth, semi-structured phone interviews (due to the COVID-19 pandemic), focusing on participants' app usage for work and leisure in their daily lives. Our participants had a range of education levels, from no formal schooling to those pursuing college degrees in rural areas. We discuss strategies emergent users adopt to overcome various challenges and barriers to smartphone use. Our findings revealed that emergent users had high sophistication in their usage of smartphones, spanning user-generated media, remote education, skilling, and other areas. Their multi-faceted app usage was not just motivated by infotainment and leisure, but also driven by instrumental needs amidst COVID-19 lockdowns. However, there was still a lack of understanding of basic features (e.g., accounts, passwords) as well as an acute understanding of constraints (e.g., bandwidth, cost) that often go unseen. As a result, there was a strong dependence on family, friends, and tools such as voice support to accomplish basic tasks. Drawing on these findings, we suggest further directions and offer insights for researchers, designers, and organizations committed to developing smartphone-based technologies for emergent users. In summary, we make the following contributions to the HCI and ICTD communities:

- We expand existing knowledge on technology practices among low-income groups by providing an in-depth study of emergent users' smartphone usage in their daily lives.
- We provide an understanding of emergent users' motivations and usage of their smartphone and various smartphone applications.
- We highlight their everyday challenges and experiences pertaining to low textual and digital literacy, infrastructure, privacy, and gender.

Documenting emergent users' interactions with internet-enabled smartphones could guide future research and design opportunities. We believe our research insights are one step in this direction.

2 LITERATURE REVIEW

Our paper draws on work within HCI4D and ICTD that explore technology use among emergent communities in the Global South, a broad term used to refer to developing countries with emerging economies (formerly known as Third World countries) [62, 70]. We start our literature review by providing an overview of technological interventions in the Global South designed for prescribed use. We then situate our work within prior HCI4D literature focused on understanding organic emergent use of mobile phones over the years, and present gaps that our research seeks to fill.

2.1 Prescribed use of technologies in HCI4D

The field of ICTD has long been interested in the design, development, and evaluation of technological interventions catered towards marginalized communities in the Global South. Since early 2000s, research in ICTD has explored the role of mobile phone-based interventions in supporting agriculture (e.g., [53]), education (e.g., [32]), health (e.g., [12, 14, 55]), and employment (e.g., [22]). For example, 99 DOTS is a mobile-based low-cost solution for tracking medication adherence in tuberculosis patients in developing regions [12]. In addition to designing for developmental goals, there has been a recent emergence of studies motivating the ICTD community to shift its focus from the socio-economic definition of development to non-utilitarian personal development in emergent economies [4, 5, 10, 18]. While some studies explicitly designed for leisure and entertainment (e.g., [79]), others used elements of entertainment and fun to drive developmental activities (e.g., [31, 60]).

Studies in HCI and ICTD communities have found that textual interfaces are unusable for low-literate users and error-prone for novice literate users [43]. Consequently, another thread of research has focused on designing and evaluating accessible interfaces for low-literate users on low-end mobile phones, tablets, and PCs. Several researchers have studied the use of text-free input modalities such as speech (e.g., structured speech and freeform speech) [52, 53, 67]. In addition, there have been comparative studies examining the usability of various combinations of input-output modalities such as speech input, audio output, graphics, and touch [13]. Several voice-based forums have also been developed for low-end feature phones to facilitate citizen journalism and social engagement within rural communities "too remote to access the Internet, too low-literate to navigate the mostly text-driven Internet or too poor to afford Internet-enabled devices" [45, 46, 79, 80]. For instance, CGNet Swara is one such voice-based forum that enables callers to record audio messages of regional interest, as well as listen to messages recorded by others [46]. While prior work studied the use of voice modalities through various interventions on low-cost mobile phones, our findings suggest interesting implications for designing voice support for smartphones, which we discuss in detail later in Section 5.

With increased penetration and affordability of smartphones, recent studies in HCI4D have designed, developed, and examined the use of smartphone-based interventions in various contexts [72, 76, 85], from Chopra et al.'s employment generating, crowdsourcing platform in rural India [11], to Yadav et al.'s peer-led educational intervention for community health workers [84]. Most of the above work includes technological interventions that were designed to be used in a way prescribed by researchers conducting the study. In our work we seek to understand how users appropriate what is available to them over a period of time. We look at the organic, emergent use of internet-enabled smartphones that users own or have access to and their experiences and challenges in using these devices.

2.2 Understanding emergent use of mobile phones

An important thread of research in HCI4D and ICTD has focused on investigating the emergent use of existing technologies and tools in the Global South. Increasing smartphone penetration in the Global South has motivated recent studies to examine and investigate the use of smartphones for work and livelihood needs [34, 76, 78, 81]. For example, Varanasi et al. examine the role of WhatsApp in supporting teachers from low-income schools [77]. In the context of agriculture, Dhaygude et al. recently studied the information seeking behavior and digital platform usage (e.g., WhatsApp groups) of farmers from rural settings in India [15]. They highlight factors such as trust, digital literacy, and peer support playing a crucial role in the uptake of smartphones for work-related information seeking. In our work we seek to understand overall use of internet-enabled smartphones by emergent users not limited to a particular domain. We extend findings from previous studies around challenges pertaining to limited digital literacies and intermediation, which we discuss in detail in section 5.

There is also research that explores the use of specific apps like WhatsApp and Facebook in low-resourced settings [6, 36, 75, 77]. WhatsApp in particular is a popular platform among emergent users in India [6]. Balkrishan and Joshi conclude through a mixed-methods study that an automated, simpler registration process, and reduction of choices, caters to the easy adoption of WhatsApp among new smartphone users, especially those with low levels of literacy [6]. In another study, Kumar uncovered the leisure-driven engagement practices with Facebook among socio-economically disadvantaged youth from urban India [36]. While our goal is to understand the gamut of applications that emergent users use, we extend findings from previous studies by uncovering interesting ways in which WhatsApp is being used by these user groups.

Previous studies have focused on the usage of specific features in smartphones by new technology users [15, 16, 33]. Karusala et al. analyse language-related challenges faced by emergent smartphone users from India, such as with spellings, translation, and keyboard typing [33]. Studies have also investigated the information security issues and practices adopted by emergent smartphone users. Doke et al., for example, argue that low-literate users' needs for privacy and protection are no different than other users, and thus there is a need for usable security and privacy interventions [16]. In addition, several past studies have examined the privacy challenges faced by women in the Global South [1, 63, 64]. Zamora's most recent study examined how new internet users in India and Brazil tried a lite smartphone for a month on an Android Go device that was given to them for the purpose of the study [86]. They highlighted barriers to smartphone adoption such as issues with login management, as well as new smartphone users' dissatisfaction with lite apps due to limited features offered [86]. Our study reinforces many of these themes in the broader context of general and emergent smartphone use; we revisit the comparison in the Discussion section.

Another important thread in HCI4D has studied mobile adoption and use to understand the everyday experiences and interactions of marginalized groups with their mobile phones [8, 17, 37, 40, 82, 83]. For example, Wyche et al. studied rural Kenyan women's routine use of their low-cost mobile phones and highlight gendered challenges that constrain their mobile usage [83]. In addition, a recent study by Malhotra et al. explored how access to a mobile phone provides agency to women domestic workers in Delhi for their work-related tasks, while also reinforcing existing gender and social class-based inequalities [40]. Our goal is to study emergent smartphone use not just among women but also men from low-income communities. We later discuss in section 5 how some of our findings reinforce and extend prior work on gendered challenges and workarounds adopted by women to navigate their smartphone usage.

Prior research in HCI have also examined the entertainment-driven media sharing and consumption practices in both urban and rural context in India [38, 51, 56, 69]. For example, Smyth et al. in 2010 described the sharing and consumption of entertainment media on feature phones [69]. In 2013, Kumar et al. uncovered the role of piracy in media acquisition and consumption among low-income communities [38]. O'Neill et al. in 2015 examine mobile phone and media sharing practices among smartphone users in urban and peri-urban areas of India [51]. These studies were conducted back when internet was largely unavailable and unaffordable for most low-income communities (before the "Jio effect"), and smartphone penetration among low-income communities was still limited in India. In our study we seek to understand entertainment-driven media practices among low-income smartphone users across both urban and rural India at a time when media applications abound. Our study extends prior findings on media consumption and sharing practices in the context of internet-enabled smartphones; we revisit this later in Discussion section.

Researchers have also logged participant's real time use of their smartphone to understand usage patterns [30, 42]. For example, Mathur et al. collected large-scale smartphone usage data of 215 users in urban India over a period of 8 months to understand their app usage, interaction with notifications, and battery charging patterns [42]. However, these studies have been done primarily in relation to expert smartphone users from mostly urban settings in India. Most relevant to our work is a recent study by Ismail and Kumar that looked at the internet and social media practices of women community health workers (ASHAs) in urban India who obtained Internet access after Reliance Jio was introduced in India [28]. This paper looked at how ASHAs appropriated smartphones and the internet to move away from the margins to fully participate in their local communities. Their findings indicate that ASHA's online practices were motivated by self-empowerment in their personal and work life. The ASHA workers in this study had attained education up to the 10th grade. In our work we include both men and women across education levels (from no schooling to those pursuing college degrees in rural areas), from both urban and rural locations across 9 states and union territories in India. Specifically, we focus on participants' everyday smartphone usage, experiences, and challenges. We examine strategies emergent users adopt to overcome various challenges and barriers to smartphone use. We consider how findings from our study reinforce, extend, or challenge findings of these previous studies in the Discussion in Section 5.

3 METHODOLOGY

We conducted a qualitative study to understand the usage, experiences, and challenges of emergent smartphone users from low-income communities in India. Specifically, we sought to investigate the following research questions:

- **RQ1:** What are emergent users in low-income communities using smartphones for?
- **RQ2:** What strategies do emergent users employ to ease smartphone adoption and navigation in their day-to-day lives?
- **RQ3:** What are their experiences, challenges, and constraints pertaining to low-literacy, ownership, and privacy?

Upon receiving approval from Institutional Review Board, our study took place over six months between January and June 2021, in both urban and rural regions in India, and consisted of semi-structured phone interviews with 30 participants.

3.1 Semi-structured Interviews

We conducted in-depth semi-structured phone interviews with 30 participants (10 women) in March-April 2021. Of these, 11 of the participants were from low-resourced urban areas of New Delhi, whereas the rest were from rural areas of states including Chhattisgarh, Bihar, Rajasthan, Uttar Pradesh, amongst others. We asked our contacts at two partner organizations that extensively work with low-resourced communities to connect us to potential interviewees, followed by purposive and snowball sampling [23, 71] to recruit smartphone users. To ensure we recruit participants of the targeted demographics i.e., from low-income communities, we kept a maximum yearly household income cut-off at INR 3 lakhs (approx. USD 4.1k) [50]. We began the interview with a brief explanation of our research to participants, and then asked questions to understand their demographic characteristics, their app usage in daily lives for work processes and leisure, experiences, and challenges in context to digital literacy, smartphone ownership, and privacy. Some example questions included, *"What do you primarily use your smartphone for? What apps do you usually use on your phone? (e.g., Google, WhatsApp, Facebook, TikTok, etc.)"*, *"Do you think about minimizing your internet usage? How?"*, and *"Any challenges you faced initially or still face while trying to use your smartphone?" *Note: example of apps mentioned in the round brackets were provided as probes to the participants.* The first author conducted the interviews on the phone (due to COVID-19 travel restrictions), and all the conversations with participants took place in the Hindi language. The interviews lasted between 25 minutes to 46 minutes, and were audio recorded with interviewee's permission. Participants were compensated with a mobile recharge of INR 200 (approx. USD 2.72) for their participation after the interview.

3.2 Participant Demographics

Our 30 participants (10 women) included 11 from low-resourced urban areas and 19 from rural areas. Table 1 provides participants' demographic details. The average age of the participants was 27.33 years (min: 17, max: 52, median: 23). Overall, 5 participants had completed or were pursuing college degrees (all in rural areas), 6 were enrolled in 11th or 12th grade, 16 had completed 10th grade or below, and the remaining 3 participants were non-literate. Participants from urban areas included students, housewives, and others employed in informal sectors, such as courier delivery, footwear business (see Table 1), whereas the most common occupation in rural areas was agriculture and daily wage labor work, with an average household income of INR 49700 per year (approx. USD 576). Most of our participants across both urban and rural areas lived in large multi-generational families consisting of their spouse, children, parents, and siblings. Additionally, all these participants were internet users and had access to 4G data. They recharged their phones every month with 4G data pack costing INR 149-199. Interestingly, 15 out of 30 participants purchased a smartphone within the last 1 year due to COVID-19 lockdown in India, whereas 7 of the participants had purchased it within the last 2-3 years.

3.3 Data Analysis

Our data consisted of audio recordings (approx. 20 hours) from 30 semi-structured interviews. The audio recordings were transcribed and translated to English before conducting the analysis. We wrote memos alongside data collection to identify potential themes emerging from the data [9]. We stopped the data collection once our data had reached saturation across the emergent themes. We then used inductive thematic analysis [44] to analyze our data. The authors began by reading through the data several times to identify the initial set of codes. The first two authors then conducted multiple rounds of open coding by rigorously discussing and refining the codes. The refined codes (e.g., "shared smartphones", "limited recharge", "searching via mic", "exchange of media", "watch short videos") were finally clustered into high-level themes to understand smartphone usage patterns.

3.4 Positionality

All authors are of Indian origin, currently living in India and/or the United States and have conducted research with diverse marginalized groups in India. Three authors identify themselves as female and one as male. Two authors are from partner organizations that extensively work with low-resourced communities. Three of the authors have more than two years of experience working on technology for marginalized populations in the Global South while one of the authors has more than sixteen years of experience. We are, thus, well-positioned to examine smartphone usage trends among emergent users. Our commitment towards studying smartphone usage among emergent users is motivated by the larger goal of examining the challenges and unrealized opportunities in designing technologies for emergent users.

4 FINDINGS

We structure findings around our three research questions focused on what, why and how of smartphone usage by emergent users. We first provide a detailed account of the apps being used by our participants, and how their motivations and social realities shape their usage of these applications, followed by a discussion of various practices and strategies being adopted to navigate their smartphones.

Table 1: Demographics of our participants

Demographic	Urban Areas (11)	Rural Areas (19)
Age	Min: 17, Max: 38, Mean: 28.54, Median: 24	Min: 17, Max: 52, Mean: 27.63, Median: 23
Gender	Men: 6, Women: 5	Men: 14, Women: 5
Education	0 to 10th grade: 10, <12th grade: 1	0 to 10th grade: 9, < 12th grade: 5, BA/MA/pursuing degrees: 5
Employment	Domestic helper, courier delivery, cook, footwear business, labor in cloth shop, gym trainer, student, housewife	Farmer, daily wage labor, teacher, cobbler, unemployed, student, gram panchayat worker, nurse, painter, housewife
Household Income per year (INR)	min: 90000, max: 300000, avg: 153816	Farming/daily wage – min: 40000, max: 60000, avg: 49700 | Other professions – min: 33000, max: 240000, avg: 129660
Smartphone since	< 1 year: 7, < 2-3 years: 0, > 3 years: 4	< 1 year: 8, < 2-3 years: 7, > 3 years: 4
Family size	3 - 6	4 - 10
Location	Delhi: 11	Chhattisgarh: 10, Bihar: 2, Rajasthan: 2, Jharkhand: 1, Gujarat: 1, Haryana: 1, Orissa: 1, Uttar Pradesh: 1

4.1 What are emergent users using smartphones for?

Our participants used a variety of applications on their smartphones (see Table 2). Their usage was not only motivated by desire for leisure and infotainment, but also spurred by increasing digitization and sudden COVID-19 lockdown in India.

4.1.1 Used media apps for informal communication with friends & family, and self-expression. We found that WhatsApp was the most popular communication app among our participants. Past studies have reported extensive use of WhatsApp for media sharing [51] and passive usage among emergent users [6]. Our findings uncover emergent users' evolving media and communication practices. WhatsApp was used for video calling, one-to-one chat, and group chat, as well as for self-expression, through the use of statuses and emojis. Many participants (27 out of 30) frequently used video calls to connect with loved ones on WhatsApp, which especially increased due to restricted mobility during India's Covid lockdown [47]. Participants preferred video call as it provided a sense of accomplishment and acted as a "feel-good" for them, unlike a regular phone call which was the norm. However, more novice participants were hesitant, and video called only when asked by others. Frequent disruptions and slow internet were often a barrier to a good video call experience; 20 out of 30 participants experienced regular network-related challenges while video calling, which led to unclear audio and frozen video. One participant shared,

> "We video call sometimes, but I prefer the way you are calling (regular phone call by interviewer). I don't hear proper sound while video calling, so what is the point of doing that. "**(P05, 30, Male, Delhi)**

While video call was used to connect with loved ones, online audio call was used to connect with acquaintances when regular phone calling was not working. Overall, regular phone calling was preferred. Participants used WhatsApp for informal communication such as one-to-one chat or group chat. WhatsApp groups included, religious groups, family groups, news groups, general knowledge groups, and entertainment groups. Such groups typically had between 150-250 numbers of participants, and our participants were usually added to these by their social contacts. Communication on these groups usually happened via media-exchange i.e., photos, videos, and audio-messages, and the content was often dependent on the occasion (for e.g., festivals) or group intent (e.g., religious). A woman participant shared, *"I am a follower of guruji (religious leader), we have to put a message daily in the guruji group [...] I send a message in that group daily by typing jai guruji, shukraana guruji (blessings)... like this."* 3 male participants reported creating and administering WhatsApp groups for sharing news and stories.

Participants frequently used the "status" feature on WhatsApp (23 out of 30). They reported putting photos, videos, local music, motivational quotes, and shayaris (a form of poem) on their statuses (See Fig. 1 (c)). Those who did not put status updates would see others' statuses and expressed a desire to learn. 12 of our participants reported using emojis and stickers, while some found it time consuming and therefore only used these on special occasions like birthdays, festivals, or when putting a status. One participant said,

> "While writing a message, we put emojis in between, or we use these as a form of design.... If I am typing a message, then we give a form of design in the starting, then we type the message, and then use the emojis again. I put these so that the message looks good." **(P28, 25, Male, Chhattisgarh)**

A few younger male participants (4 out of 30) used Telegram for communication and features such as stickers and gifs. Telegram has no upper limit on the document size and was therefore used to share larger files. One of the participants had used it for downloading and sharing movies from uncopyrighted public channels. Overall, we found that participants found Telegram more "modern" and difficult to use compared to WhatsApp.

Table 2: Apps used by emergent users classified by app category. The number in bracket represents the number of participants who were using that app.

Category	Apps
Communication apps	System calling (30), WhatsApp (30), Telegram (4)
Social media apps	Facebook (14), Instagram (11), Twitter (3), Snapchat (2)
Video apps	YouTube (30), TikTok (17), Sharechat (5), MX Takatak (2), Zilli (2), Chingari (1), Moj (1), JioTV (1), Zee5 (1), Josh (1)
Games	Candy crush (5), Ludo (5), FAU-G (2)
Financial apps	Paytm (8), PhonePe (6), Google Pay (5)
Educational apps	Google meet (3), Zoom (3), MS Teams (2), Google classroom (2), Byjus (2), Cisco webex (1)
Work-related apps	Myntra courier app (1), MGNREGA (1), Jeevika (1)
Others	Google search (11), Google assistant (6), Photo/video editing (5), English learning (2)

4.1.2 Used media apps for infotainment and leisure extensively . We found out that emergent users extensively use their smartphones for infotainment and leisure-related activities. Majority of the participants (17 out of 30) expressed interest in watching short entertainment videos on TikTok (before it got banned in India [48]). TikTok required no sign up and hence was easier to use for many of our participants. Due to more active users, TikTok contained relatively more new and diverse videos, making its feed more relevant and engaging. Participants stopped using TikTok once it got banned. They installed other alternatives like Sharechat, Mojo, Zilli, Josh, etc. to continue watching short videos, but did not like it as much as they liked TikTok. Instagram was also used for watching 'Insta reels', but its use was limited to younger men.

4 women participants reported using Facebook for reading feeds, posting updates, comments, or photos, and "liking" others' posts. Some used Facebook Messenger and chat for talking to their friends, although they reported facing a lot of network problems. Additionally, most participants found the Facebook interface overwhelming, and complex compared to WhatsApp. A participant added,

> "I started using Facebook because people told me that there are photos, videos, and lots of information on that. I was also told that we could make friends on Facebook, but I found all these things to be difficult than WhatsApp. I found it similar to WhatsApp content-wise, so I felt WhatsApp is better, why should I use Facebook then? WhatsApp is fine." **(P28, 25, Male, Chhattisgarh)**

We found that YouTube was being used for watching media and as a search engine. Participants used it to watch content ranging from comedy videos to watching tutorials on smartphone use, to seeking medical help. A participant shared his experience of using YouTube,

> "If we are facing any problems... or some function is not working in the phone... then we use YouTube to take help [...] if there's any technical problem related to MGNREGA (Indian act to provide guaranteed wage employment to rural households) or any personal life problem, we go to YouTube to find a solution...like seeing videos if we are facing health issues like constipation. "**(P16, 35, Male, Haryana)**

Several participants reported using YouTube to watch TV soaps and movies. Smartphones were increasingly seen as a substitute to TV due to factors such as absence of a TV set, high electricity bills, etc. One of the women participants shared her experience of using the Zee5 app to watch TV soaps,

> "I download Zee5, and then watch whichever serial (Indian word for TV soap) I want to. If I am unable to watch it at 9pm, then I download the serial so that I can watch it later. "**(P23, 19, Female, Uttar Pradesh)**

2 out of the 30 participants also reported using Netflix and Hotstar on their phones. However, none of the participants had subscribed to these services, and instead asked for passwords from someone in exchange of favors. Extensive prior work has reported that low-income communities' primarily use mobile phones for entertainment and leisure [4, 5, 57, 69]. Our findings reveal emergent users' changing landscape of media consumption for infotainment and leisure purposes, especially with the advent of accessible video-based content.

Figure 1: (a) (b) self-edited animated videos for WhatsApp status, (c) example photo put on a WhatsApp status

4.1.3 Created self-edited content across media applications. While majority of the participants consumed content across media applications, we observed that a few of our participants actively engaged in content creation. These were men (5 out of 30) with relatively higher literacy levels among our participant group yet were unemployed. Apps like Snapchat and Picsart were used to click "better" photos, and to increase brightness and contrast to make them more attractive. One of the participants reported using an app to create animated videos (see Fig. 1 (a) and 1 (b)) with music to post on WhatsApp statuses:

> "There is an app called Vi... it is called Vi... something. You can edit your photos in that and make yourself sit on an elephant for instance or show yourself dip in water. So, there are many options in that, and I create these videos and send them. "**(P28, 25, Male, Chhattisgarh)**

Participants also reported creating stories and "reels" with background music, containing motivational content and *shayaris* (a form of poem) to post on Instagram. Likes and comments were a strong incentive to generate and post content, as one participant shared,

> "I put motivational and success stories on Instagram along with reels. In the stories, I put motivational content, and in reels, I generally put songs and shayaris. It feels good to put these [...] My reels get approximately 300 likes now, earlier I used to get very less likes "**(P11, 18, Male, Delhi)**

3 out of our 30 participants reported creating TikTok videos of dancing and acting, when the app was available in India. One of the participants shared, *"My son used TikTok... I used it a little with him. He likes to dance, so we used to make dance videos and send it to family. He used TikTok daily when it was there."* **(P04, 32, Female, Delhi)**. Media generation on lower end phones among low-income populations in the Global South has been reported in prior work [46, 51, 79], but we observed that the increasing availability of smartphone media platforms has prompted emergent users to experiment with more complex media-based content generation and share it within their online social networks.

4.1.4 Have had increased use in work related communication during Covid. With increasing smartphone penetration, several recent studies have examined and investigated the use of smartphones for work and livelihood needs [34, 77, 78, 81]. Our findings highlight the increased adoption and use of smartphones and applications like WhatsApp for work, triggered by limited mobility during the COVID-19 lockdown, with some participants calling WhatsApp *"a must in today's time"*. We observed an extensive use of WhatsApp for work-related communication such as coordinating and connecting with colleagues and customers, among our participants involved in small businesses. An employee in a cloth store shared,

> "We have WhatsApp groups for work consisting of customers, friends, family, everyone... we have to send photos on these WhatsApp groups after they visit the shop and tell them price of the cloth when they ask... "**(P03, 17, Male, Delhi)**

Another participant reported using WhatsApp groups for exchanging work-related information and documents, as well as sending photos to update work progress to senior government authorities. Participants also used video calls to show their products to their clients, to overcome challenges pertaining to restricted mobility during the Covid-19 lockdown:

> "For our work, we must talk to our parties (clients) on WhatsApp about items, placing orders, and visits. After the lockdown, the parties don't come visit, so we mostly communicate over WhatsApp [...] we send them photos of shoes on WhatsApp, and they tell us the orders and everything... you can even talk face-to-face (video call) with them and show them the products. "**(P08, 34, Male, Delhi)**

An unemployed participant from a rural area now used an app to port mobile numbers from one operator to another for other people to generate some income, while an urban participant reported using an app to deliver courier packets. 2 out of 30 participants reported using apps for finding employment during the lockdown, e.g., Apna Job and WhatsApp groups for job vacancies.

4.1.5 Used media apps also for occupational skilling. Some participants who were self-employed and just starting out their own businesses reported using media apps like YouTube and Instagram for keeping up with occupational trends. A participant who repaired mobile phones for a living reported following mobile repairment pages on Instagram. He further added, *"lockdown has taught us everything."* Applications like YouTube were also used to familiarize oneself about emerging trends, as one of the participants shared, *"We search by saying latest footwear designs on YouTube, and they are then shown. We look at those designs, and the videos also teach how to create those designs."* **(P08, 34, Male, Delhi)**. Participants described using YouTube to upskill and gain professional work-related knowledge. P18, a rural local ayurvedic doctor, used it to learn about recent advancements in his field, and treatment of diseases:

> "On YouTube, there's a new yog abhyaas (yoga practice) video by Baba Ramdev everyday which I watch. Additionally, I see ayurvedic videos on health problems in men and women. I also watch videos related to treatments and diagnostic tests for diseases [...] Yes, I gain knowledge by learning from YouTube. What's an MRI machine, it's benefits, advantages of CT scan and Sonography... I watch about all of these on YouTube" **(P18, 30, Male, Chhattisgarh)**

Malhotra and Lin reported similar patterns of use of YouTube by domestic workers in Delhi to supplement skill development [40]. In addition to watching videos for occupational skilling, a few of our participants (2 out of 30) reported having their own YouTube channels for work. One of them was a student who did this alongside studies:

> "I have created my own YouTube channel along with studies. There are many visually impaired brothers and sisters living nearby, so we have learnt seeing them how they do everything... how they use Talkback (software) to operate their phone. We talk about these things in the YouTube channel and tell them how to do these." **(P17, 18, Male, Chhattisgarh)**

The other participant uploaded videos related to mobile repair on his channel, although he gradually lost motivation when the subscriber count did not increase.

4.1.6 Used limited financial applications. 10 of the 30 participants (all men) used Paytm, Google Pay and Phone Pe for phone recharges, bill payments and money transfers. Additionally, 5 out of these 10 participants also used UPI (an instant real-time payment system) for making payments.

> "In the lockdown, there was no way I could have gone out to get my phone recharged. This was the main reason why I started using Google Pay, to get my phone recharged myself. And I also use it now for making any other online payments "**(P13, 19, Male, Jharkhand)**

Some of our women participants had heard of Paytm and had seen male members of their households using these applications and aspired to learn these apps for their own use. One of the driving factors in adoption of payment apps was earning money in the form of cashbacks, vouchers, and coupons, especially amongst rural participants. Our participants used strategies such as referrals within a group of friends, planned transactions with a friend to get cashbacks, and installing all available payment apps to get the initial sign-up bonuses.

> "There are many apps these days in which you get money after downloading it. I used these apps for timepass... and earn some money while passing my time. We get coupons in Phone Pe on transferring money to someone, so, our friends started sending the money, and then returning it amongst each other [...] We were getting this in Google Pay as well earlier. We used to arrange for 3 people and transfer money amongst each other to get these coupons. "**(P28, 25, Male, Chhattisgarh)**

Despite awareness and interest among some participants, there were challenges and concerns that participants experienced. Several reported that they could not use e-wallets as they had not yet completed their *KYC documentation* (full form: Know Your Customer, is a standard due diligence process of identity and address verification followed by financial institutions). A few participants (3 out of 30) expressed fears of financial fraud and losing their money while making transactions online. A woman participant shared,

> "I do not use Paytm to do any bank transactions [...] I had downloaded it on the phone, but someone asked me for a link, which I had given. I suffered some loss due to this. Since that day, I have uninstalled Paytm from my phone. "**(P04, 32, Female, Delhi)**

Most participants who did not currently use financial apps shared a strong desire to use them but did not know how. Overall, payment apps were perceived to be difficult to use. A few participants had tried out different payment apps to identify the easiest and best one to use. Out of all the payment apps, participants found Google Pay and Phone Pe the easiest to use.

4.1.7 Used media apps for coordinating online education of kids. The pandemic had a strong impact on schooling among our participants' families, causing a sudden, unanticipated shift from in-person school to online school. Our participants felt pressure to get their smartphones recharged with internet packs for their children's online classes and exams. We observed limited use of specific education apps (6 out of 30) like Google Meet, Google Classroom, Microsoft Teams, and an extensive use of WhatsApp for coordinating teaching, as also reported in a recent work [59]. Participants reported using Google Classroom for submitting assignments, while Microsoft Teams and Google Meet were used for attending online classes. Participants were taught how to download and use these applications by their teachers either through a phone call or via WhatsApp groups. However, network problems were persistent on these apps along with bad audio and video quality, leading to missed classes. Some participants even faced challenges in understanding these apps.

> "I faced difficulties initially while using Google Meet, I was not able to understand it. But after my teacher taught me how to use it on the call, and my friends told me about it, I did not face any problems. "**(P02, 19, Male, Delhi)**

Much of the teacher-student communication happened on WhatsApp in our participants' families. WhatsApp groups were formed consisting of students/parents and teachers to coordinate homework, class videos, attendance, and even conduct exams. Students were expected to complete the assignments and send photos to the group. Participants studying in higher grades (11th or 12th) reported converting photos to PDF documents for submitting the assignments, using apps such as Adobe PDF. We found that voice messaging was common in these school WhatsApp groups. Participants said that teachers continued posting links to online classes on Google Meet and Microsoft teams on WhatsApp. A woman participant with a child studying in 2nd standard shared,

> "I use WhatsApp for schoolwork of my daughter, or to see if some other child has sent something on WhatsApp [...] She has exams these days. My daughter will come back from tuitions after completing the exam... I then click clear photos of her work, and switch on the data, and send it to the teacher so they can check it... "**(P09, 38, Female, Delhi)**

We observed that YouTube live was also used for online teaching in rural areas of Bihar, where the student-teacher communication happened through comments on the video.

4.2 How are emergent users using smartphones?

Despite sophisticated usage, our participants faced several constraints due to low digital literacies. They employed a variety of strategies ranging from intermediated usage to use of voice support to navigate their smartphones. Overall phones were shared extensively, and various strategies were adopted to mitigate network challenges.

4.2.1 Less literate users preferred to use voice feature instead of typing text. Participants reported a significant preference towards

using voice input for search and for messaging on communication apps, compared to text input. We observed that voice input helped low-literate users in places where they did not know how to spell a word using text entry, or where their typing speed was slow. For instance, **P02 (18, Male, Delhi)** mentioned *"If I do not know the spellings, then speaking on the mic shows the correct spellings."*

Voice search was extensively preferred while browsing applications like YouTube, Google, and Google Assistant (28 out of 30). However, participants reported that voice search is internet-dependent, and does not work in case of slow internet. In addition, many expressed that the mic often detected the voice input incorrectly, in which case they must use multiple trials and speak loudly. One participant said,

> "To search for a song, I either type or there's a mic there, right? I search by speaking on that. [...] Out of the two, I find it easier to search via mic. However, I face challenges when the internet doesn't work. During these situations it doesn't work when I speak due to slow internet. There are times when I speak something, and it shows up results of something completely else, and then I have to type. "**(P01, 23, Female, Delhi)**

Most participants preferred using code-mixed language while using voice search i.e., Hindi mixed along with few English words. Often, participants spoke certain words in English (instead of Hindi) so that the system could understand and provide accurate results to their query. A few low-literate users reported verifying the voice output (displayed in text format) before proceeding with the search results. This, however, was not possible for non-literate (3 out of 30) users due to their inability to read. One of the participants also expressed desire for an auto-complete feature in voice search like there is for text. Such a feature would automatically complete and suggest what the user wants to search and facilitate formulation of better search queries.

We found that 20 out of 30 participants used the mic feature to send audio-recorded messages on WhatsApp. Voice messaging was used over manual typing by non-literate users, and by low-literate users when they were in a hurry, required to type something longer, or to communicate in their local dialect. Voice messaging however had its own disadvantages, such as difficulties in sending private messages from crowded places.

> "I find it easier to speak and send messages, though, writing is easy as well... If I am at an open place, then I record the message, but if there are people around or chances of noise, then I type and send. Also, there are some things which are personal, so I usually type them." **(P13, 19, Male, Jharkhand)**

More experienced smartphone users among our participants reported using a mic in their initial days of smartphone use, but now preferred typing to get better at it and "exercise their minds", indicating an aspiration amongst these users to learn typing. Overall, we found that "mic" (voice search) is an important tool to help low-literate users navigate a smartphone, especially in the initial phases of their smartphone adoption journey. In a prior work, Kendall et al. uncovered how diverse socio-economic groups in urban India engage with voice user interfaces on smartphones primarily for looking up information, leisure, and learning [35]. Our findings reveal additional bandwidth-related challenges with voice input and highlight emergent users' increasing dependency on voice support in initial phases of smartphone adoption.

4.2.2 Took help from intermediaries to get started and continue usage. All participants reported facing difficulties while getting started on using the smartphone. We found that low-literate participants (23 out of 30) depended on an intermediary user to get started and continue learning. The spectrum of intermediated use in feature phones has been extensively documented in HCI literature [38, 65]. We uncover how emergent users of smartphone internet rely on intermediation to navigate complexities of smartphone interactions. We found that intermediary users included a family member, teacher, friend, or colleague well versed with smartphone use. As has been reported by a previous work [28], for women participants, their kids and husband were the popular choice for a mediator. We found that mediators acted as a source of information about new apps or features and would set up the smartphone and relevant apps for use by the beneficiary user. One participant said,

> "My sir had setup the entire phone for me. I did not know how to use a smartphone at that time, as I had never used it before. I used the feature phone at that time. [...] Bhaisaab (referring to manager at work) did everything and gave it to me. I did not do anything. Bhaisaab knows all the passwords, I do not hide anything from him. He is the only one who knows everything, I do not know anything. "**(P05, 30, Male, Delhi)**

Most participants were dependent on an intermediary's help for setting up an ID or using apps that required an account to be created. A participant shared,

> "I do not know what issue is occurring in my YouTube, it keeps prompting that an ID needs to be created [...] I do not know how to do that. I will ask my jijaji (brother-in-law) to make it for me when he visits us... he only created my play store ID. "**(P01, 23, Female, Delhi)**

After intermediaries had created an ID, participants would note it down somewhere for future use (e.g., in a paper diary or in phone). Some participants reported memorizing the user flow actions for performing certain tasks, such as calling, typing, opening an app, how to place fingers on the touchscreen, etc. However, recall after periods of inactivity posed a problem while using this technique, especially for non-literate users. One non-literate participant said,

> "Although I used to keep the phone with myself, my daughter used to teach me and tell me that papa, you must do this and that.... you know that an illiterate person just forgets everything. I learnt quite a lot in a few months from her, but it has all slipped out of my mind since the last month. Now what should I do – should I work, or should I keep all of that in my mind? "**(P21, 52, Male, Rajasthan)**

Participants talked about associated fears in exploring smartphones and trying new apps; they said they feared damaging their devices unknowingly. Relatively more literate participants seemed more

confident, and desired better control over their smartphones. They self-taught themselves through exploration and help from intermediaries. These intermediation techniques however were not just restricted to in-person enabling by the intermediaries. In fact, we also observed emergence of remote intermediation, where teachers taught students how to use education apps as discussed earlier (see 4.1.7). Additionally, several participants also used YouTube (10 out of 30) as a virtual mediator to learn the use of a smartphone or to resolve any queries. A few participants also reported learning to use a smartphone, while sitting in groups at their workplace. Overall, low-literate participants were more likely to depend on a mediator for their day-to-day usage and learning and displayed hesitancy to use anything apart from what they have been told.

4.2.3 Shared phones extensively, did not pay attention to privacy. 22 out of the 30 participants reported that they shared smartphones among their family members for phone calls and for use of communication apps. This observation is consistent with previous work on shared usage of feature phones in the developing world by Steenson & Donner, first published in 2009 [17]; In our study we found that participants who shared smartphones also shared the same ID while using communication and media apps (e.g., WhatsApp, TikTok), implying that the concept of "multiple accounts" did not exist. When asked about the phone lock feature, 26 out of 30 reported using a lock on their smartphones and most preferred using a pattern and fingerprint lock. In case of fingerprint lock, the primary smartphone owner had set his own fingerprint, while others in the family used the pattern lock. Despite using a lock, we found that participants were not bothered by privacy among family members, and everyone was aware of the passwords.

> "Yes, everyone in my home knows the pattern. I told all of them myself because we have very few mobile phones in our home. They can use my phone in case they want to call. Although this is my personal phone, but my brothers use this for calling purposes. "**(P20, 21, Male, Chhattisgarh)**

Women participants were often looked at with skepticism if they put a lock on their smartphones and were sometimes asked to remove it. Further, a few women participants reported using practices such as entity deletions [63] for deleting specific private messages on WhatsApp to prevent their family members from reading those, as **P04 (32, Female, Delhi)** said, *"If there's any chat of me and my sister which I do not want to share with anyone else, I delete the messages."* In contrast to prior work [63], app locks were not commonly used by our participants. Only 4 young men knew about an app lock and used it for apps like WhatsApp and Telegram. They shared the lock screen password with family members but kept their app lock passwords a secret.

Among participants with children, we observed that women participants' phones were primarily used by their kids to attend online classes during the COVID-19 lockdown, and kids displayed ownership over the smartphones.

> "My kids use the smartphone as well. They do not let me use it because I do not know how to use it, my daughter is the one who tells me how to use it...she says, mummy press this or that or what this function means. "**(P22, 45, Female, Rajasthan)**

This echoes previous work, which shows that women are culturally expected to share their mobile phones with family members [1, 65]. Men's phones, however, were only occasionally used by children to play games. Overall, participants extensively shared smartphones and privacy was not a key concern, especially amongst men. And as another work has suggested [49], we observed that personal privacy concerns and choices exhibited by emergent users were often governed by their socio-cultural context and pre-existing norms and values.

4.2.4 Used various strategies to manage low bandwidth. Despite financial limitations, some participants expressed high motivation to get internet recharges every month. Some did extra wage work to earn money for recharges, whereas some only got it done when necessary. A participant said,

> "If the data gets finished, we get it recharged again. If we are not able to get it recharged for 1-2 days, we do labor work and then get it done. It is very difficult to sustain without data." **(P18, 30, Male, Chhattisgarh)**

Majority of our participants talked about frequent issues around disruptive and slow internet, leading to restricted app usage and delay in getting their work done. Some perceived slow internet speed as no network, while others believed that the internet speed varies with the time of the day. Participants used strategies such as waiting for the internet to be redeemed at a specific time, using the smartphone at a specific hour to get the best speed, going to the terrace to gather more network, or putting the phone on flight mode to reduce data consumption. In case of internet depletion, 10 out of 30 participants said that they borrowed someone's hotspot or used a nearby open Wi-Fi. One of the participants said,

> "When internet is not there, all the children just wait till 12am (next date) till we get more data. Once we receive the data, we send all the photos and do whatever we want to. If it is not there, then we cannot connect anyways. We can connect to Wi-Fi (hotspot) if there is data in my husband's phone and send whatever we have to. "**(P09, 38, Female, Delhi)**

In most cases, participants felt helpless and tried to stay patient as they had no other source of internet connection. Many did not know what to do in case of no internet and sometimes perceived it as a problem with their smartphone device. When asked whether they tried to minimize their internet consumption, most did not know how and expressed a desire to learn. Only a few relatively more literate, male participants tried to minimize their internet consumption by either watching videos in low-quality, skipping less important segments like songs while watching a video, or by using an inbuilt "data saver" option in their phones to consume less internet data.

5 DISCUSSION

Our study extends existing understanding of technology practices among low-income communities in India beyond the use of feature phones. We described the various dimensions of smartphone

usage among emergent users, specifically focusing on their app usage as well as strategies for navigation. We discussed how users' motivations, experiences, and challenges shape their smartphone usage. We now reflect on what our findings might suggest in terms of designing for emergent users, and offer insights for researchers, designers, and organizations committed towards developing smartphone-based solutions for these users.

5.1 Designing for evolving instrumental needs

Users often appropriate and use technologies in ways not envisioned by designers. It is of essential importance for designers and developers to understand how users appropriate technologies to make them more useful and usable. Prior literature and anecdotal evidence suggest that low-income communities adopt smartphones for entertainment and leisure purposes [4, 5, 57]. In fact, ICTD researchers have used entertainment to draw people into instrumental use. For example, Raza et al. used similar strategies in the case of Polly, a speech-based viral entertainment system, to draw people into developmental services such as job search and health information [60, 61]. However, our study argues that emergent users are now adopting smartphones also due to increasing instrumental needs pushed by the COVID-19 pandemic and digitization. For example, several participants reported purchasing a smartphone to attend online classes during the lockdown. In addition, we found that some early adopters were using complex financial applications too motivated by various factors such as the desire to earn in the form of cashback, and mobility constraints in the lockdown. However, opportunities remain to make these complex instrumental applications (such as payment apps) more accessible and user friendly for emergent users.

While some users adopted smartphones due to increasing instrumental needs, others transitioned from entertainment to instrumental usage in an organic, self-organized way. Prior studies in ICTD have consistently reported that emergent users are far more motivated to use technology for consuming entertainment content than for 'productive' needs [5, 69]. However, our findings revealed that emergent users are now adopting existing media platforms to suit their need, whether it is leisure, entertainment, work, or learning. For instance, WhatsApp was being more commonly used as a defacto information exchange and learning tool in schools for parents, teachers, and students to connect, as opposed to more complex tools such as Microsoft Teams and Google Classroom. Our findings further substantiate that using existing platforms for coordinating large scale action is often more effective than designing custom-built ones, as also argued in previous studies [39, 54]. Using existing platforms additionally provides an opportunity to meet emergent users where they are, rather than making them bend over backwards to utilize technologies designed for a different context. With increasing availability of content in local languages, users are slowly turning towards media platforms like YouTube for upskilling as well. YouTube is enabling small businesses to grow and has transformed the level of information they can access daily. In addition, we found that women participants also used YouTube to watch videos related to cooking, gardening, and stitching to upskill themselves. A simple voice input with a tap on the mic button is enabling users to seek information from across the world. We believe content availability and ease of access to content across platforms are two major factors that govern emergent users' content choices. Easier access to content in vernacular languages enable emergent users to choose information in addition to entertainment.

5.2 Understanding emergent media practices

Our findings revealed that participants used communication apps such as WhatsApp, as well as media apps such as YouTube, TikTok, Sharechat, etc. for infotainment-related content. While we observed some commonalities in media consumption and sharing patterns with prior findings (e.g., high motivation for entertainment [56, 69], use of WhatsApp for media sharing [51]), our findings nevertheless provide rich insights into the current media practices on internet-enabled smartphones across low-income communities in both urban and rural settings. Our analysis also revealed that unlike what has been reported in prior studies [51], emergent users have now started engaging in content creation. For example, some participants actively created WhatsApp statuses, while others created reels with background music on Instagram. The increase in interest towards content creation among emergent users necessitates further exploration in designing easier and accessible content generation techniques. In earlier studies, media dealers were the main source of media acquisition and sharing for low-income mobile users [38, 69]. However, we observed that participants no longer rely on such actors. Instead, they themselves acquire media content from a plethora of media applications now available (e.g., TikTok, ShareChat) and share that across other communication apps using inbuilt android sharing mechanisms. Recent studies have investigated the use of these emerging media apps (e.g., TikTok) [68], but most of these have been done in the western context. Chirumamilla et al. suggest reimagining the ICTD discourse by embracing the elements of play and 'fun' in people's everyday lives and incorporating those affective pleasures while designing technologies [10]. Building on this, it could be beneficial to understand the usage patterns of these emerging media platforms, especially short-video applications (e.g., TikTok, Sharechat, Instagram) among new smartphone users in the Global South. An interesting question here could be to explore the reasons for increased usage and preference towards short-video content among emergent users. Specifically, deeply understanding their motivation, content consumption patterns, barriers to content generation, and experiences while using these media apps could encourage incorporating elements of play in both existing and emerging technologies catered towards emergent users. Furthermore, longitudinal ethnographic studies could be conducted to understand how emergent users adapt and appropriate entertainment-heavy media applications for instrumental purposes over a period of time.

5.3 Emergent patterns of intermediation

Our data revealed that emergent users often face constraints due to low digital-literacies, and thus rely on intermediated usage to navigate their smartphones. Prior work revealed similar patterns of intermediation with respect to more rudimentary applications on feature phones [38, 65]. While we see similar behaviors in our work, they gain new significance in the context of smartphones, as these devices contain many new affordances (e.g., touch, speech) that

could improve the independence of users. However, even if devices have evolved to be more user-friendly, we observed an associated increase in the sophistication and complexity of applications, which requires ongoing assistance to navigate. In the perpetual arms race between device capability and application complexity, novice users will always be a few steps short of independence.

Prior work has sought to develop a taxonomy of the different styles of intermediation interactions surrounding technology use in low-income communities of the Global South. For example, Sambasivan et al. described three models of intermediation–*surrogate usage* where an intermediary uses technology on behalf of the beneficiary user; *proximate enabling* where the intermediary sets up the technology to allow a user with access but without requisite technology skills to successfully use the technology; and *proximate translation* where the intermediary translates the system output to support the beneficiary user's usage of technology [65]. We primarily observed elements of proximate models to be of most relevance in the context of emergent smartphone users, especially in the initial phases of adoption where intermediaries helped setup applications and specific features. In addition, we also observed a new category of *'remote enabling'* where emergent users are now using phones to interact with intermediaries remotely. A recent work uncovered adoption of similar remote repairing practices by mobile repair workers to connect with their end-users facing technical damage during the pandemic [58]. These remote interactions with intermediaries happened both—synchronously and asynchronously. In *synchronous remote enabling*, participants were interacting with intermediaries synchronously using phone calls and communication apps. For example, students were taught how to download and use education apps such as Google Classroom by their teachers synchronously over WhatsApp groups during the lockdown. On the other hand, in *asynchronous remote enabling*, people interact with virtual intermediaries (e.g., online video tutorials) asynchronously to seek help. For instance, media platforms like YouTube were often used to watch video tutorials when one was stuck while using the smartphone. While the use of remote intermediation techniques was certainly aggravated by restricted mobility and limited in-person socializing due to the COVID-19 lockdown in our study context, we foresee continued reliance on such interaction techniques.

5.4 Voice support for emergent users

Research in ICTD has long sought to reduce emergent users dependency on intermediaries by designing voice-based interfaces to assist people with limited digital literacies [46, 60, 61, 79]. Prior work has recognized that voice-based interfaces are not only simpler than text-based alternatives, but also inclusive of people with low-levels of literacy and visual impairment [79]. In addition, voice interfaces help in alleviating comfort levels while speaking about sensitive topics to a system instead of having to engage with a human [41]. Past deployments of these interfaces have found value in designing voice- input and output techniques to support mobile users from low-income settings. However, technology has become much more pervasive in recent years, and smartphone penetration has vastly increased in low-resourced communities [26]. One of the key findings from our study is the use of inbuilt voice input features to navigate media and communication apps by emergent smartphone users. For example, emergent users now use voice input for searching and messaging instead of relying on text-based input techniques or taking help from someone else for typing. Our data indicated that emergent users often type slowly and are not comfortable with spellings. This indicates potential to focus on designing more user-friendly voice input techniques for fields requiring text entry. For instance, our participants expressed a desire for autocomplete-based voice input like text-based autocomplete. This could further support emergent users who face difficulty in typing and help users complete a search or input that they were intending to do with greater speed. Measures such as validation checks for voice-based input could allow low-literate users to verify whether the voice-input was detected correctly. Going further, exploratory studies could also be conducted to identify further avenues where voice input could support emergent users (e.g., tasks such as messaging, in-app navigation, and document creation). Our findings show that there are merits to the ongoing efforts in Natural Language Processing for low-resourced languages as participants can speak more comfortably in their local languages rather than being forced to speak in languages beyond their comfort, as also evidenced in a previous work [33]. Further, research studies could look into enhancing these speech recognition engines to support diverse dialects and nuances encapsulated within emergent users' speech for better results. While voice input helps bypass limitations due to low-textual literacy, it assists users only while navigating fields requiring text-entry. Our findings revealed that there is still fear and hesitance when it comes to exploring and using new apps (especially ones which are mostly text-driven). Recently, there has been some effort to enable output-based voice navigation in smartphone apps [7, 19, 74]. In addition, *Zabaan* enables apps to have voice annotation for interface components to support vernacular voice guidance and easy navigation [74]. Gautam et al. in a recent work found that elaborated, colloquial voice annotations in local languages could help facilitate initial interactions of low-literate users with technology [19]. Though our findings revealed that emergent users are also slowly catching on to terminologies within the context of using a smartphone, such as 'network', 'hotspot', 'share', etc. Therefore, while designing interfaces for emergent users, it is also critical to be cognizant that certain terminologies (in English) have become part of the user's vocabulary and a preference as opposed to elaborate local translation of such terms.

5.5 Rethinking privacy and shared use for emergent users

Our findings resonate with prior findings on privacy challenges with shared mobile phone use in the Global South where device sharing is both a necessity and expected cultural practice [1, 28, 64, 65]. HCI and ICTD researchers have previously described that device sharing practices are often subsumed within existing power differences and gender inequity [1, 8]. We find a similar practice in the setting we studied—for example, women participants often employed strategies such as deleting personal messages on communication apps to maintain privacy. The COVID-19 pandemic unveiled unique patterns within the device sharing ecosystem. For example, women participants' phones were predominantly used by

their kids to attend online classes during the lockdown; however, men's phones were only occasionally used for shorter durations for leisure purposes. This could be an indicator of how the pandemic might have acted along with already existing power differences to impact the device sharing ecosystem. While the use of device lock was common and aligned with prior findings [63, 64], our participants used device locks just for the sake of it, and its use was generally not triggered by any privacy concerns. We observed that our participants were overall not bothered by privacy and did not actively think about it, which resonates with prior sentiment in Global South [29]. In fact, those who used device locks faced constraints due to prevalent device sharing norms, and as a result had to remove the lock from their phones. Only a handful of participants were aware of and used an app lock. Therefore, even though digital devices such as smartphones offer support to maintain individual privacy, there is need to rethink the design of these technologies while considering their visibility, and their potential implications on the user in a "shared" context with existing power differences and cultural norms.

6 CONCLUSION AND FUTURE WORK

The field of HCI4D and ICTD has long been interested in understanding mobile phone adoption and usage in the Global South. Since the launch of Reliance Jio in 2016, internet-enabled smartphones have become affordable and accessible across low-income communities in India. We presented our findings from an in-depth qualitative study of smartphone usage among emergent users from low-income communities in urban and rural areas of India. We found that emergent users used various strategies to navigate their smartphone usage (for e.g., intermediated usage, voice support), and faced frequent challenges related to low bandwidth and low digital literacy. Despite these challenges, emergent users had sophisticated app usage spanning media and communication apps, which was motivated by leisure, infotainment, educational and livelihood needs, and constraints brought about by Covid-19 lockdowns. We concluded by discussing further directions and insights for research and design of both existing and emerging technologies catered towards emergent users. As part of future work, we are investigating the use of emerging alternate input-output modalities by low-literate users in their everyday interactions. Going ahead, we also plan to conduct large-scale logging studies with emergent users to understand their smartphone usage patterns more in-depth.

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