

Social Media Platforms for Low-Income Blind People in India

Rough Draft (Accepted at ASSETS 2015)

ABSTRACT

We present the first analysis of the use and non-use of social media platforms by low-income blind users in rural and peri-urban India. We examine the benefits received by low-income blind people from Facebook, Twitter and WhatsApp and investigate several constraints that impede their social media participation. We also present a detailed analysis of how low-income blind people used a voice-based social media platform deployed in India that received significant traction from low-income people. In eleven-weeks of deployment, fifty-three blind participants in our sample collectively placed 4784 voice calls, contributed 1312 voice messages, casted 33,909 votes and listened to the messages recorded by others 46,090 times. Using a mixed-methods analysis of call logs, qualitative interviews, and phone survey, we evaluate how low-income blind people used the platform. We present a detailed analysis of the strengths and weaknesses of the platform, and benefits it offered to low-income blind people.

Keywords

Blind; Social Media; Interactive Voice Response System; ICT4D; HCI4D

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

1. INTRODUCTION

About 90% of the world's 285 million visually impaired people live in low-income settings [36]. India has the largest blind population: It alone has more than 63 million visually impaired people [20]. A majority of them have constrained access to computing devices, Internet services and local-language digital assistive technologies like screen reader software. These barriers in accessing the information severely impede their education opportunities [31], job prospects [18], social status, and potential to overcome poverty.

In the last decade, social media platforms have revolutionized the way information is reported, consumed and shared. They have deeply impacted the lives of billions of people around the world. In addition to providing entertainment, information and abundant user-generated content, they are seen as an instrument of social change. Many people believe social media revolution to be the biggest shift since the industrial revolution [26,41]. Social media platforms are playing a pivotal role in supporting academic collaborations [11], managing crisis response [27], political campaigning [16,37] and organizing civil society movements like the Arab Spring [25,28]. Even during the recent devastating earthquake in Nepal, the BBC used public chat feature of Viber for sharing information and safety tips with the affected people [42].

Some researchers have studied use of social media platforms by people with disabilities in the developed world [4,5,7,30,38]. However, to our knowledge, the use of social media platforms by people with disabilities in the developing world has received no attention. A few researchers have studied the role of Facebook in providing employment opportunities to young adults living in urban slums in Nairobi [39], improving communication, technology and English language skills of young adults living in urban slums in South India [23], and empowering marginalized people living in urban slums in Brazil [15]. Wyche et al. has studied Facebook use and non-use by low-income rural Kenyans and found that the constrained access of devices, Internet and electricity impede online participation [40].

Though there is evidence of social media use and non-use by low-income people in the developing world, there is no information on the participation of low-income blind people in the social media revolution. There is a need to study the use and non-use of existing social media platforms by blind people in low-income settings, identify benefits received and challenges encountered by them, and assess the need for designing a new accessible social media platform.

As a primary contribution, we present the **first analysis** of the use and non-use of social media platforms by low-income blind people living in rural and peri-urban India. We found that low-income blind people in India use social media platforms to expand their connections, receive instrumental benefits, uplift their social standing, and access informative and entertaining content. However, the cost of smartphones and internet access, difficulties in understanding the language of the audio output of screen reader software, inaccessible features of existing social media platforms and lack of training has resulted many blind people to either not explore these platforms or abandon their use. These financial constraints, socioeconomic barriers, limited English language proficiency, and infrastructural limitations accentuate the need for designing a new social media platform that is cognizant of the constraints of blind people living in low-income settings.

In a prior work, we designed and deployed a new social media voice forum in Hindi language. The platform was built using Interactive Voice Response (IVR) technology and was accessible using any phone. It enabled callers to record voice messages, listen to the messages recorded by others, vote on them and share them, without needing the Internet access. The platform was deployed to engage low-income people and understand whether community moderation can be used for managing content on IVR systems. The platform saw significant adoption by low-income communities and it received over 25,000 calls, and 5000 voice messages from over 1500 people in eleven-week deployment. The details on the design of the system, deployment in India, and results on community moderation and engagement by low-income

communities are available in [32]¹. To our surprise, the social media voice forum also received broad and impassioned usage by low-income blind people in rural and peri-urban India. In fact, more than 26% participants on the platform were blind.

In this paper, we re-examine the social media voice forum presented in [32] as part of the broader landscape of social media use by blind people. As a **secondary contribution**, we present new findings that specifically explain how blind people from low-income settings used the social media voice forum. In particular, we present detailed analysis of the content generated by blind participants, demographics, the reasons for the high adoption of the platform, strengths and weaknesses of the platform, benefits and challenges offered to blind participants, and design implications for future systems.

Our analysis revealed that the blind participants deeply valued their interactions with other participants on the platform. The analysis of call logs of fifty-three blind participants revealed that although blind participants in our sample were just 3.5% of all the users, they contributed 25% of the total voice messages, 24% of the total number of playback of these messages, 19% of the total number of calls, and 25% of the total number of votes casted by users. Our qualitative interviews and phone surveys received emphatic responses from blind participants. We found that blind participants received several instrumental benefits, shared entertaining content and built social capital by using our platform.

2. RELATED WORK

The use of social media platforms by people in developed countries is a well-studied phenomena [6,11,29]. However, a few researchers have studied the use of social media platforms by people with visual impairment in the developed world. Fuglerud et al. studied usability and accessibility challenges faced by visually impaired Norwegian people in using social media platforms [7]. Wentz and Lazar presented a usability evaluation of Facebook Desktop and Facebook Mobile interfaces and found the mobile interface to be more accessible than the desktop interface [35]. Wu and Adamic conducted a large-scale empirical study of how blind people use Facebook and found that a majority of the content they produce relates to vision impairment [38]. They also concluded that blind people receive more feedback on their content, though their Facebook activities are similar to that of the general population. Brady et al. have investigated how social networking platforms can be used for asking visual questions of blind users [4]. The findings from these studies, though immensely insightful, can't be generalized to blind people in developing countries as most of the users in these studies had a high socioeconomic status and were from developed countries.

The research on social media usage by low-income, low-literate users in developing countries has received disproportionate attention. Prior research efforts have demonstrated that people in low-income settings derive instrumental benefits, earn social capital and access entertainment by using social media platforms. Young adults from an urban slum in Nairobi have used Facebook to support income generation activities, search employment opportunities, and seek remittances from friends and family abroad [39]. Their counterparts in South India have used Facebook to expand their social connections, learn English

language skills, and transform self-perception [23]. People from urban slums in Brazil have used Facebook to access entertainment, organize and plan protests, and communicate with friends and families [15]. Mäkinen and Kuria analyzed the role of social media platforms as an alternative medium for participatory journalism during a post-election crisis in Kenya [12]. Bosch has studied the use of Facebook by South African students and lecturers for teaching and learning [3]. Bosch has also explored the role of social media platforms in enabling young women in South Africa to express and experience their sexual identity [2]. Wyche et al. studied Facebook use and non-use by low-income rural Kenyans and found that the limited access to computers and smartphones, expensive Internet access and unreliable electricity impede online participation [40].

A few researchers in the Information and Communication Technologies and Development (ICTD) community have conducted research on understanding the role of technology for blind people living in urban India. They provided general recommendations for designing low-cost assistive technology [19], explored the usage of screen reader software [13,17], and analyzed workforce participation and underemployment [18]. Pal and Lakshmanan have noted that "*access to assistive technology is beginning to create an important and vocal population of people with vision impairments who interact independently on social media*" [18]. However, the participants in the study were not representative of blind people in rural and peri-urban India.

The literature targeting design and the use of technology by low-income blind people from rural areas is severely limited. One of the primary reasons for the limited attention are the challenges experienced by researchers in making meaningful contact with them and gaining their trust. The only exception is the study delineating challenges faced by low-income blind people in accessing educational content and their coping mechanisms. The researchers found that the acute shortages of Braille content, high quality audio books, and inexpensive TTS for local languages have motivated low-income blind people to create, consume and curate peer-produced audio content [31].

Although researchers have studied technology use by blind people in India, few researchers have studied their social media usage. The only cursory findings on social media use by low-income blind people is presented in [32] where an IVR based social media platform was designed and deployed to investigate whether community moderation can be used for managing the content generated by low-income people in India. In addition to low-income people who used their platform, they also received traction from low-income blind people. However, the analyses presented in the work focuses on all users of the platform rather than specifically analyzing call logs of blind participants, content generated by them, their demographic details, and the impact of social media platform on their lives. To the best of our knowledge, no other work gives insights on how low-income blind people use social media platforms.

Several other researchers have used IVR technology to design voice forums for enabling low-income, low-literate people to record and share voice messages. Some notable examples are *Avaaj Otalo* for providing an agriculture discussion forum for farmers in India [21], *CGNet Swara* for providing a citizen journalism platform for tribal people in Central India [14], *Ila Dhageyso* for providing a civic engagement portal for tribal people in Somaliland [9], *Polly* for sharing job opportunities in

¹ We have not referred to our prior work in the third person to present a complete and fair picture to reviewers.

Pakistan [24], content creation and dissemination portal for people in rural India [1], among others [8,10].

In the next section, we present our analysis of how low-income blind people in India use (or don't use) social media platforms.

3. SOCIAL MEDIA USE AND NON-USE

To gain easy access to low-income blind people from rural and peri-urban areas, we contacted a non-profit organization² in Rajasthan that conducts free computer training for blind people. The training lasts six months and each training batch has around eight participants. During the training, students learn to use Talking Typer, screen reader software like JAWS and NVDA, Microsoft office suite, Internet websites, and social media platforms. Students have to take an external examination at the end of six months. After passing the examination, students receive a government-issued certificate that is mandatory to apply for several government jobs in Rajasthan and other states.

3.1 Methodology

We recruited current and past students of the training program and their social contacts for investigating social media use and non-use by low-income blind people. We used purposive sampling and snowball sampling to select participants who satisfied one of the following inclusion criteria:

- Must be a blind from low-income family.
- Must be an instructor or facilitator.

In order to understand the broad spectrum of social media use and non-use, we selected participants such that we can classify them in four categories on the basis of their social media use: recent adopters, disenchanted users, consistent users and non-users. Recent adopters were participants who joined a social media platform in the last six months, disenchanted users were participants who either stopped using social media platforms or used them rarely, consistent users were participants who used social media platforms at least once a week for more than six months, and non-users were those who never used a social media platform. We also interviewed instructors and facilitators of the training program to understand the opportunities and challenges technology offers to blind students in the program. We focused our attention on the three most popular online social media platform in India: Facebook, WhatsApp and Twitter.

We used a mixed-methods approach spanning several qualitative and quantitative analyses. Our primary tool of analysis was twenty-two in-depth semi-structured qualitative interviews. We conducted observations on how computers, phones, and social media platforms were used by participants. We also analyzed activities on social media accounts of participants. We interviewed eighteen social media users, two instructors and two facilitators. Each interview began with demographic questions, followed by general questions about participants' experiences with mobile phones, computers, and the Internet. We then asked several questions to understand social media practices of blind users, strengths and weaknesses of the platforms, benefits and challenges offered, and constraints that impede social media participation. The interview with facilitators and instructors focused broadly on various social, technical, societal and economic barriers faced by low-income blind students that impede their access to information technology.

² Anonymized for review



Figure 1. Blind participants using social media platforms in the computer lab.

Out of the eighteen social media users, eight were recent adopters, two were disenchanted users, five were consistent users, and three were non-users. Twelve interviews were conducted face-to-face in the premises of non-profit organization while eleven were phone interviews. The interviews were conducted by the first author (male, 28 years) in Hindi. Each interview lasted around forty-five minutes. We digitally recorded each interview and took detailed notes on paper. We reviewed and analyzed data immediately after conducting each interview. The insights obtained from the data analysis informed questions for the next interview. We continued to recruit participants until no new observation emerged. We spent ten hours observing participants using computers and social media platforms to understand their challenges and usage patterns (see Figure 1). We also analyzed the social media accounts of five participants to understand their usage patterns and to corroborate what they reported in the interviews.

3.2 Participants Demographic Information

Thirteen participants were totally blind whereas seven were partially sighted. Out of the seven partially sighted participants, four had 20% visibility, two had 40% visibility and one had 5% visibility. Six participants were blind since birth while others lost vision at the average age of 9.75 years (min=2 years, max= 26 years, s.d.=7.28 years). Only one participant used a computer before losing vision. Fourteen participants were skilled in reading and writing Braille content. Four participants reported themselves as slow while using Braille content: Three of them were partially sighted and one was a late blind.

Our sample had sixteen male participants and two female participants. The average age of participants was 24.2 years (min=17 years, max=34 years, s.d.=4.18 years). Fourteen participants were students, three were unemployed and one person ran a Photostat and stationery shop earning a monthly income of USD 200³. One participant was a middle school student, two were high school student, nine were pursuing a bachelor's degree, and two were pursuing a master's degree. Two participants finished a master's degree while two participants left studies after completing high school. The participants were from five states in India. A majority of them were from villages (N=10) and small towns (N=2). The remaining participants were from second-tier cities (N=6). A bulk of the participants were from low-income households. The median monthly household income was 166 USD (min=USD 0, max=USD 1667, s.d.=USD 473). The average number of members in a household were seven (min=4, max=13). By normalizing the monthly income by family size, we found that

³ In this paper, we use an exchange rate of 1 USD = INR 60

half of the participants had USD 0.88 per day and two-third had less than USD 2 per day for meeting their needs. Two participants had no family income and they were living on a monthly stipend of USD 8 provided by the government. A majority of the participants were from families of daily wage laborers ($N=4$), farmers ($N=3$), small shop-owners ($N=2$), carpenters ($N=1$) and household help ($N=1$).

All participants owned a mobile phone. 40% of the participants reported sharing their phones with family members. Nine participants used a basic phone, seven participants had a feature phone and two participants owned a smartphone. All participants used phones primarily for sending and receiving voice calls, only one participant used it for sending SMS. Five participants used a screen reader software on the phone: Talkback, Talks and eSpeak were the specific softwares. Six participants reported using Internet on phone for accessing social media websites ($N=5$), email ($N=4$), news ($N=3$) and downloading applications and songs ($N=1$). All but one participant reported using a computer at least once in their lifetime. However, only ten participants reported using a computer at least once in the last three months. Fourteen participants used a computer in a shared setting while three had computers at home. All computer users used a screen reading software and five used a magnification software. Both JAWS and NVDA screen reader software were equally popular among participants. Eleven participants reported using the Internet regularly on a computer, primarily for accessing social media websites ($N=8$) and email ($N=7$), downloading books and songs ($N=3$), and online shopping ($N=2$). Three participants used Internet rarely while four never used the Internet on a computer.

3.3 Analysis

We used open coding and axial coding to analyze the data obtained from qualitative interviews and observations. We present the results of our analysis in the following sub-sections.

3.3.1 Social Media Use

The distribution of participants across Facebook, Twitter and WhatsApp is depicted in Figure 2. All but three participants had used at least one of the social media platform. Despite an unexpectedly high adoption, seven participants were unable to answer our question: *what social media platforms are*. Many of them never heard the term *social media* or *social networking platforms*. In fact, one participant explained social media as “*the organizations that perform social work*”. Participants heard about Facebook, Twitter, and WhatsApp from multiple different sources: friends, training institute and mainstream media. Nine participants learned about these social media platforms from their family members and acquaintances, generally when they overheard the name of these platforms during a group conversation. Seven participants heard about these platforms during the training while two participants got a line about them while listening to a program on television or radio where viewers were encouraged to ask questions on Twitter or Facebook. Fourteen participants had an account on Facebook, six had an account on WhatsApp and four were Twitter users. Nine participants had an account only on Facebook while the number of such users for WhatsApp was only one. One participant had an account on both WhatsApp and Facebook. Four participants had an account on all the platforms. On the basis of numbers alone, Facebook was the most preferred platform while Twitter saw the least traction.

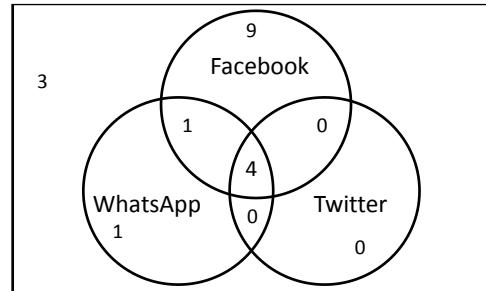


Figure 2. Venn diagram describing the distribution of participants across Facebook, Twitter, and WhatsApp.

Two of the fourteen accounts on Facebook were locked or perceived inactive by the users either because participants forgot their password or they abandoned the use of Facebook. Sixteen users were able to describe our satisfaction with the features and usage of Facebook. Two users never heard of Facebook. Our sample contained a wide variety of users in terms of the time they were actively engaged on Facebook (min=7 days, max=4 years, average=12 months). The distribution of the number of Facebook-friends of participants was skewed by outliers (min=4, max=700). The median number of Facebook-friends were 11 while the average was 122. We found an order of magnitude difference between the median number of Facebook-friends for participants in our sample and the numbers reported for blind people in developed countries [4,38]. We observed that recent adopters had lesser friends than consistent users and disenchanted users. Lada and Adamic also reported a similar finding and concluded that the difference in network size is dependent on the length of time users have been on Facebook [38]. Many participants used Facebook to broaden their social circle. On an average, 75% of their Facebook-friends were people they knew in an offline setting while 25% of their Facebook connections were people they met only online. In addition to strengthening the existing connections with the blind community, some participants used Facebook to have more interactions with sighted Facebook users. This was more evident for consistent users: 69% of their Facebook-friends were sighted people while this number was a mere 17% for recent adopters. The participants used Facebook for an average of 1 hour per day. Two participants reported using Facebook for more than 2.5 hours each day.

Participants found broad usage of Facebook. They used it for increasing social circle, accessing and sharing news, songs and other informational content, sending photos and chatting. To our surprise, five participants described Facebook as an e-commerce platform. They perceived it as a platform to reach a person who runs business on Facebook and to market your own business. One of the participants explained his Facebook experience as follows: “*Facebook is for making friends and developing your business. If anyone like to buy something, they can buy it. When I will start a business, I will give a presentation to my friends, market it and put advertisements on Facebook.*” Participants’ Facebook experience was dominated by advertisements. Though Facebook serves advertisements to all its users, sighted users often learn to ignore these advertisements. On further investigation, we found that a screen reader software divides Facebook website in four panes. The last pane majorly consists of sponsored content. Because participants had limited experience switching between the panes using JAWS commands, these advertisements became central to their overall Facebook experience. The instructor noted

that the advertisements were quite irritating to some students: “Once the cursor moved to the last pane, many students were just lost. They just got frustrated. They need much more practice to operate Facebook properly.”

The most popular feature on Facebook was chatting with friends. This was also corroborated by analyzing Facebook activities of the participants. Many participants considered online chatting as “opening doors to a new world full of opportunities.” A majority of the participants (N=9) reported that their Facebook-friends primarily use Facebook for chatting. The participants enjoyed interacting with both Facebook friends and Facebook-strangers (those Facebook users who are not their friends on Facebook). Facebook chatting also enabled them to have an asynchronous communication similar to SMS where they could send a reply at a time of their convenience and without spending any money on telephone calls.

WhatsApp was the second-most popular social media platform among the participants. Ten people explained the usage of WhatsApp to our satisfaction. Out of those ten people, six people had an account on WhatsApp. WhatsApp was primarily considered as a social media platform for mobile phone. The participants found broad usage of WhatsApp including group chatting, individual chatting, and sharing songs, videos, voice-messages and even location. Many participants considered it as a platform for strengthening existing connections rather than facilitating expansion of their social network. Primarily, because a WhatsApp user can share information only with people on the contact list of his phone. The users in our sample enthusiastically appreciated the feature of sending voice messages to other users.

I like sending voice messages on WhatsApp. It is simple to use. We hear the messages recorded in the voice of our friends. It is also cheaper than a phone call. Phone calls are good only for having long conversations. The only downside of voice messages is: it requires a faster connection.

P1 (Male, Bachelor's Student, 23 years, Rajasthan)

A majority of the people perceived Twitter as a social media platform to connect with celebrities and experts, and have “intelligent conversations with friends”. Though ten people knew the purpose of Twitter, only four people had an account. One account was locked. Even those who had an account, reported using it only for an average of five-minutes per day. Many users reported that either they don't have time to learn a new platform or they find it less engaging than Facebook and WhatsApp. The thought was echoed by instructors: “Only a few students used Twitter, mainly because none of their friends are active Twitter users”. Two participants in our sample also reported using LinkedIn and Google Plus.

Out of the five participants who were both WhatsApp and Facebook users, three stated Facebook as their favored social media platform while two preferred WhatsApp. Participants preferred Facebook because it enabled them to have interactions with strangers and expand their social network. WhatsApp was preferred primarily because it enabled them to exchange voice messages. WhatsApp also instilled a sense of faith in some participants: They were more convinced that they are not talking to imposters.

I trust people on WhatsApp more than the people on Facebook. Facebook has many people with fake profiles because it is easy to create a fake email ID and thus, a

fake Facebook account. While creating a WhatsApp account, you have to use your own phone number.
P2 (Male, Bachelor's Student, 23 years, Rajasthan)

3.3.2 Benefits

We found that participants derived significant benefits by using social media platforms. Nine participants valued these platforms as an efficient instrument to increase their social circle. Eleven participants reported using these platforms for chatting mainly to strengthen their existing links. All participants deeply valued their existing offline social networks of friends, colleagues and teachers. They reported receiving a majority of the instrumental information about scholarships, educational material, health schemes, and employment opportunities through them. This assertion is also supported by one of the instructors who believed the network of blind students to be very cohesive: “They know most of the blind people in the state. They will even tell you how many people in Rajasthan are blind. They rely on each other to share information.” Fourteen participants reported that they meet their closest friends only twice in a year. Despite having access to mobile phones, they were able to interact with their friends only once or twice in a month because of inability to afford voice calls⁴. These constraints are even more prominent when their friends are from different state as voice calls made outside the state incur higher call charges. One of the participants whose monthly family income is USD 23 expressed: “I only call my friends when I have a question related to career or studies or to wish them on festivals. Every time I call, I have to speak for 4-5 minutes and that is expensive.” Though many of their friends still don't use these social media platforms, online chatting has empowered these users to have longer and frequent conversations with their friends who are using these platforms. They reported that despite being separated by geographical distance, they feel connected to their friends. These interactions not only supplement their need to access instrumental information, but also provide avenues for fun and entertainment.

Now I get in touch with my friends using Facebook chat. Some of my friends live in other states as well. Now, three of my friends are in touch with me using Facebook. We can share information on business opportunities and competitive exams with each other. We also share songs.

P3 (Male, Unemployed, 30 years, Rajasthan)

Six participants considered social media platforms as an avenue to get information on interesting topics, and current news in India and the world. Five participants used these platforms for sharing photos, videos, jokes and even documents with others. We also found aspirational use of social media platforms. Five participants reported that often they were treated in a condescending manner by the society. They believed that their friends, colleagues and sometimes even family members had an inferior outlook towards them.

People think that even if we study then we will not get a job. When we go to mobile shops for recharging the Internet, they think that we are joking. They have a perception that even if I use Facebook who is going to be friends with me.

P4 (Male, Bachelor's Student, 25 years, Delhi)

⁴ The cost of voice calls in India is around 1 cent per minute.

Two people reported that they use social media platforms to attain a higher social position and get respect from sighted people. They had a deep desire to show the world that they can operate computers and are no less confident and knowledgeable than sighted users. They use social media platforms for demonstrating their use of computers and familiarity with technology.

When I say to people that I use a computer, then no one believes me. They think I am blind and when they can't operate it how I will be able to. But when I send a request on Facebook, they know it is me who has sent that request. People in my locality now know that I study and use the computer.

P4 (Male, Bachelor's Student, 25 years, Delhi)

3.3.3 Challenges Experienced

Participants experienced several challenges while using social media platforms. Most participants studied in a Hindi-medium school and had poor English language proficiency. Eleven participants complained about the language of audio output used in the screen reader software. They were unable to understand English words and American accent outputted by JAWS and NVDA. They cope with it by reducing the playback speed of screen reading software for understanding the accent. Some participants even took months to get used to the accent. The limited understanding of English also lowered self-confidence and self-prestige of many participants. They felt disadvantaged and considered “*using the Internet a dream*” for people with limited skills in English and JAWS.

I have to keep the speed of the talking software very slow and this hampers my productivity. Though our intellect is comparable to sighted people, we are unable to compete with them because of the lack of English skills. I feel disadvantaged.

P2 (Male, Bachelor's Student, 23 years, Rajasthan)

The instructors also considered the language of screen reader software to be one of the major limitations that impede students' use of social media platforms and the Internet. According to the instructors, 90% of the students who came to the training program in the last two years were unable to write their name in English. The training was significantly impacted because of limited English language proficiency. The instructors had to translate many words and sentences to Hindi.

Though chatting was the most favorite and frequently used feature, many participants were unable to induce use of it to their gratification. The participants were unable to understand the output of screen reading software for abbreviated words, texting language and code-mixing. Many participants preferred WhatsApp just because it provided a functionality to send voice messages in chatting.

Nothing is better than sending messages in our voice. It helps in having a clear conversation. Many people use abbreviations for words. The screen reader software can't read such content. It is very easy for a sighted user to read it, but blind people struggle a lot while chatting.

P1 (Male, Bachelor's Student, 23 years, Rajasthan)

Eight participants reported that listening the chatting messages in the voice of senders would be the best functionality Facebook can

offer. One participant even reported that this feature would be like “*lighting a candle in darkness*”. Though Facebook messenger has voice chatting functionality, none of the participants knew about Facebook messenger. The participants referred to the voice of screen reading software as robotic and devoid of any emotions. It impacted the user experience significantly.

If I could hear the voice of my friend rather than JAWS reading his message, it would be so much better. JAWS is like a robot. I can't get the feelings and emotions when JAWS read out messages sent by my friends. It diminishes the impact of chatting.

P5 (Male, Unemployed, 24 years, Madhya Pradesh)

Six participants complained about the accessibility features of social media platforms and navigational challenges. In WhatsApp, when a user press the icon for sending a voice message, the output from screen reader software overlaps with the voice message sent by participants. This impacted the user experience of several WhatsApp users in our sample. Many participants reported that the screen reader software randomly stopped working, possibly because of the unsupported font or script. Several participants found it challenging to navigate across panes and to remember the commands of screen reader software. Many features on these social media platforms also do not have associated commands. For example, several participants complained about the lack of commands for Facebook chatting. Rediffmail, a popular email service in India with 93 million subscribers, was also unsupported by JAWS. Three participants found it difficult to send friend requests on Facebook. Often they don't know the email address of a friend and when they search the name on Facebook, they find thousands of profiles with the same name. Because they are unable to distinguish among profiles by looking at the profile picture, they have to go through an “*arduous and irritating*” process of reading profile descriptions. Three participants complained about the lack of captions on photos posted by their friends. Three other participants expressed strong sentiments for the limited adoption of audio captcha on many websites: “*Can you imagine that the website of Indian Railways doesn't have an audio captcha? What is the point of learning a computer if I can't even book my train tickets??*”

Four participants found it difficult to learn and understand features of social media platform. Many of the features and terminology aren't localized to geographical regions. The participants found *wall*, *tweet*, and *follow* difficult to grasp. Both participants and instructors noted the importance of training and continued usage of the platforms to overcome these semantic barriers.

3.3.4 Social Media Non-Use

We asked the eight recent adopters whether they will be able to use social media platforms after completion of the training. All of them stated that social media platforms play a pivotal role in their life and they would very much like to continue using the platforms. Though all of them desire to continue using these platforms, half of them reported that they will not be able to use them at all while two of them reported that they will be able to use them only rarely. This means that 75% of the recent adopters are expecting to become a disenchanted user or a non-user in a near future.

The major reason for social media non-use by disenchanted users, possibility of potential abandonment by recent adopters and inability of non-users to explore these platforms is same: **The cost of devices and the Internet**. The finding is also supported by prior research on the use of social media platforms by users in low-income settings [3,40]. Eleven participants attributed the cost of devices and the Internet as the primary reason for the non-use of social media platforms. Many participants were living under severe poverty and owning a smartphone or a computer was seen as a luxury rather than a necessity. Many participants reported belonging to sections of society “*where no one has seen a computer or smartphone before.*” All but one participant were dependent on others for supporting their expenses. Many participants asserted that the first thing they will buy after becoming independent is a computer or a smartphone for learning more information.

I rarely shave and get a haircut because I am unemployed. My financial situation is terrible and I have no family support. If there is no income, there will be no phone, no Internet, and no Facebook. When I will have enough money, I will buy a computer and make an account on Facebook.

P6 (Male, Unemployed, 34 years, Rajasthan)

Some recent adopters were worried that they will forget whatever they have learnt by the time they will buy a computer because of the lack of practice. Though some organizations distribute low-cost computers and smartphones to blind people, participants reported that it will be challenging for them to pay even for the Internet: “*Paying for Internet recharge would be tough. A smartphone without the Internet is like a dumb phone.*”

Participants also expressed difficulties in visiting Internet café for accessing social media platforms. The facilitator of the training program reported that approximately 50% of incoming students are also given mobility training. All participants but three reported not stepping outside the home and training institute alone. Even if they visit an Internet café, the accessibility features are not activated on the computers.

Going to a café is a laborious task. The computers there doesn't have screen reading software. I have requested the owner to install them, but he is not interested because few blind people go to his café.

P7 (Female, Unemployed, 27 years, West Bengal)

Two recent adopters had a strategy to fight this challenge. They planned to download NVDA in a portable flash drive and run the software from the drive itself. NVDA provides the ability to run it from a portable USB drive without needing administrative privileges on a computer.

3.3.5 Desire to Use New Media Technologies

Several participants expressed a strong desire for accessing information and entertainment using new accessible technologies designed specifically for them. The success of voice messages on WhatsApp, desire for hearing messages in the voice of sender, problems with the language of screen reader software, lack of access of computing devices, and severe financial constraints prompted us to seek alternative low-cost technologies that can be appropriated for them.

In recent years, various researchers and practitioners have designed *voice forums* for enabling low-income, low-literate marginalized people in the developing world to report, access and



Figure 3. A blind participant accessing the demo of a voice forum.

share information [1,9,14,21]. The voice forums are built using IVR technology. It enables users to record voice messages and listen to the messages recorded by others. It facilitates asynchronous communication among users which is similar to chatting. The successful deployments of voice forums in ICTD community prompted us to investigate the adoption and usage patterns of IVR technology among participants. All participants had used an IVR system at least once in last three months. Nine of them used it for enquiring balance on their pre-paid phones, six of them used it for speaking to a customer service center, and the remaining used it to access a conference calling system. All participants also found IVR systems easy to use while sixteen participants were satisfied with the user experience on these systems. Only two participants found IVR technology difficult to operate and time consuming. They believed that several blind people will not even know how to use an IVR system. Though one participant found IVR systems usable, he avoided using them out of the fear that “*the excessive use of voice calling will damage ears because of radiation emanating from phone*”.

In a group session, we showed a demonstration of a Hindi-language voice forum to eight participants and two instructors where they could call a number and press 1 to record a voice message and press 2 to listen to recorded messages. This voice forum can be visualized as a single voicemail system shared by all the users. Though voicemail feature is very popular in North America, they are rarely used in India. We received an enthusiastic response from the participants: everyone found the voice forum easy to use. Many participants were excited about the potential of the voice forum for voice chatting. Three participants also recorded a voice message during the demo session (one of them is shown using the forum in Figure 3). Participants liked the fact that they will not have to listen to the “*robotic voice of screen reader*” and the messages will sound natural. Many participants believed that all of their blind friends will be able to use this system. They reported the voice forum to be much better than the IVR systems they have used for accessing customer services.

4. Voice-based Social Media Platform

In our prior work, we designed, built and deployed a social media voice forum for low-income, low-literate people in India to understand whether low-income participants will be able to moderate the user-generated content on the voice forum without any outside support. The deployment saw significant adoption by low-income people in rural and peri-urban India. In an eleven-week deployment, we received 25,381 calls by 1521 callers, 5376 voice messages recorded by 516 people, around 200,000 playbacks of these messages, 40590 upvotes, 99150 downvotes

and 773 share events. The platform received high usage from low-income people. Though we did not promote the platform on any of the channels accessible to blind community, to our surprise, we found that the voice forum was extremely popular among visually impaired users in India. The detailed discussion on the design of the platform, deployment, adoption by low-income users, success of community moderation in managing content on the platform and improving the quality of user-generated content, the challenges in financial sustainability is presented in our prior publication [32].

Here, we focus our attention specifically on the use of the social media voice forum by low-income blind people in rural and peri-urban India. In particular, we empirically evaluate:

- Content produced, consumed and shared by blind participants.
- Usability experience of blind participants.
- Impact of the social media voice forum on blind participants.

In the next sub-sections, we briefly discuss the design of our social media voice forum for the sake of providing a complete picture. Thereafter, we present a detailed analysis of how low-income blind people used the voice forum, what content they produced, strengths and weaknesses of the voice forum, and benefits and challenges offered to blind participants.

4.1 Design

The social media voice forum enabled low-income people in rural and peri-urban India to record and listen to user-generated entertaining content like songs, jokes, poems and anything that participants wanted to share. Similar to the *like* feature in Facebook, our system also requested callers to cast votes while listening to messages on the voice forum. Similar to Facebook *wall*, each caller was played voice messages sequentially. The votes casted by callers were instrumental in deciding the quality of the messages and the order in which the messages were presented to callers. Similar to the *share* feature on Facebook, the participants could also share a voice message with others. An account was automatically created the first time participants called our system. The username for each account was the phone number used for placing the voice call.

For accessing the system, participants placed a call on a toll-free (1-800) number. Once the call is connected, participants were requested to select one of the four options by pressing the relevant key on their phone keypad:

1. **Access analytics on your messages.** Callers could press 1 to access details of the number of people who have heard the messages recorded by them. The callers could also access the latest rank for each message and the breakdown of the number of participants that heard them.
2. **Record a new message.** Callers could press 2 to record a new message. The callers were encouraged to introduce themselves in the beginning of their message. The maximum permissible length of messages was seventy-seconds. After recording a message, the callers received an SMS containing a five digit numeric code corresponding to the message they just recorded.
3. **Listen, rate and share messages.** Callers could press 3 to listen to the messages in the voice forum. Each

message was played sequentially. At the end of each message, the callers were required to either give an upvote to the message by pressing 1 or downvote it by pressing 2. They could listen to the message again by pressing 3. They could share the message by pressing 4. On selecting the option to share content, we forwarded the caller an SMS containing the numeric code for the shared message. In the SMS, callers were encouraged to forward the SMS to their friends to share the numeric code for the message they wanted to share.

4. **Access a message directly.** Callers could press 4 to enter the numeric code for accessing a message directly. This feature alleviated the need to wait for a particular message to show-up in the playback list.

We also gave callers an option to modify their vote next time they heard a message on which they have previously casted a vote. Callers could also barge-in at any time for any prompt to indicate their selection. All the prompts were recorded in a slow and clear diction by a native Hindi speaker (male, 28 years). We developed the system by using IVR Junction [33] and Voxeo Prophecy [43].

4.2 Methodology

We used a mixed-methods approach to analyze the usage by blind participants. We conducted a structured phone survey that asked one pre-recorded question to callers every time they called the voice forum. The survey consisted of fifteen subjective questions recorded in Hindi. The questions were asked to understand the background of participants, collect demographic data, evaluate the user experience and efficacy of community moderation, and investigate the impact of the voice forum on them. The survey was completed by a total of 204 participants. Although we did not specifically ask them, while giving information on their background, 26% of the survey respondents ($N=53$) voluntarily identified themselves as blind [32]. **For the analyses presented in this paper, we only consider data contributed from those fifty-three respondents who self-reported themselves as blind.**

For our user analysis, we studied survey responses contributed by the fifty-three blind participants. We translated and transcribed their responses in English and analyzed them using open coding. The average length of the response was 38 words. We also studied the call logs of the fifty-three blind participants to understand usage patterns.

For content analysis, we randomly sampled hundred messages from the voice messages recorded by blind participants and inspected them on several criteria like gender, content type, location of callers, the quality of the recording etc.

We also conducted thirteen semi-structured qualitative interviews with blind participants to investigate the user engagement, and measure the strengths and weaknesses of the social media voice forum. The interviews were conducted in Hindi by the first author. We reviewed and analyzed data immediately after conducting each interview. The insights obtained from the data analysis informed questions for the next interview. The interviews were translated and transcribed in English, and were analyzed using open coding.

4.3 Analyzing Call Logs of Blind Participants

On quantitatively analyzing call logs of fifty-three blind participants, we were surprised to see their disproportionate usage of the system. The fifty-three participants who self-reported themselves as blind were only 3.5% of all participants on the

platform. However, they were responsible for recording approximately 25% of all contributions. The median number of messages recorded by blind participants was 13 (max=170 messages). Seven of them recorded more than fifty messages each. They placed 4784 voice calls (19% of total calls received), casted 7350 upvotes (18% of all upvotes) and 26559 downvotes (27% of all downvotes), shared 57 messages (8% of all shared events) and listened to messages 46090 times (24% of all playback events).

Forty-three participants answered all questions on the survey while ten participants answered the survey partially. Although a few blind participants did not record any voice message, they were heavy listeners of the content contributed by others. Two such blind listeners called the voice forum 23 times and 123 times respectively. These listeners also recorded emphatic and verbose responses (with an average length of fifty-words) to the questions asked in the phone survey. The number of messages recorded by blind contributors, votes casted by them, messages listened by them, and the average length of responses given by blind listeners is a strong evidence that both blind contributors and listeners deeply valued the social media voice forum.

4.4 User Analysis of Blind Participants

Our analysis revealed that the blind participants in our sample were from thirteen states in India. Two-thirds of them were from rural regions. 93% of the respondents were male, and 7% were female. The average age of the blind participants was 24.6 years (min=15 years, max=42 years, s.d.=8.1 years). They came from a broad range of educational backgrounds: 17% held or were pursuing a Master's degree, 19% held or were pursuing a Bachelor's degree, 21% were in high school, 10% were in middle school, 2% only completed primary school, 2% were uneducated and 10% were trained in music. 19% of the participants did not share information on their educational background. 24% of the blind participants were employed and earned an average monthly income of USD 107 (min=USD 5, max=USD 334, s.d.=USD 110). 45% of the blind participants were student, 14% were teachers, 12% were unemployed, 9% worked either as a telephone operator or a singer. We did not have this information for 20% of the participants.

All blind participants owned a mobile phone. 26% of them reported using SMS, another 26% of them reported not using an SMS while 48% of them did not share this information. Only one blind participant had an email account and three participants had a Facebook account. Many participants had never even heard of Facebook and often responded: "*We don't have a Facebook account, but we have an account in Bank of India.*" They associated the word 'account' with account in a bank rather than an account on Internet services.

4.5 Content Generated by Blind Participants

All the randomly sampled messages that we analyzed were recorded by male participants. In sixty-eight messages participants reported their location, in seventy-seven messages they shared their name and in twenty-five messages they shared their phone number publically with all participants on the voice forum. The participants were from nine states in India. All messages but one were high-quality recordings. The average length of voice message was forty-seven seconds (min= 5s, max=70s, s.d.=22.2s).

39 messages were similar to the messages that people generally share on Facebook and Twitter. This category comprised of

discussion on trending topics on the platform, generic informative messages recorded for other participants, messages intended for specific people, discussion on topics of national and regional interest, requesting feedback from other participants, requesting or sharing phone number etc. We found seven flirtatious messages where participants showered special attention and adulation on the female contributors. One person also recorded a message reprimanding those who were recording flirtatious messages for blind women participants. We found four messages where participants spoke about visual impairment. Twenty-four messages were poems. Most of them were written to express feelings on love, separation, motherhood, visual impairment, environment, women empowerment, success and persistence. Twenty-one messages were songs that consisted of Bollywood songs (n=8), folk songs (n=10), and even recordings from a playback device (N=3). To our surprise, we saw nine messages where people shared general knowledge information with each other by asking questions or recording answers to the questions asked previously. One example of question asked on the forum is: *World Environment Day is celebrated on which date?* Two messages were jokes. We also found two messages containing abusive language and one message where a participant pretended having an intercourse. You can listen to twenty-five randomly selected messages recorded by the blind participants at <https://soundcloud.com/socialmediavoiceforum/sets/random25>.

4.6 Adoption by Blind Participants

The social media voice forum received a huge response from blind people. Although blind people living in India are severely under-represented on online social media platforms, the forum saw broad and impassioned usage by low-income blind people without any targeted outreach efforts. Moreover, although 26% of the survey respondents self-reported themselves as a blind, we believe this number is a conservative estimate of the actual percentage of blind participants who used the voice forum. The representation of blind people on our platform (~26%) is significantly higher than their representation on Facebook, Twitter, WhatsApp or even among the population of India. In addition, the participants were spread out all across India. They recorded several positive sentiments about the platform and shared impactful stories on how the platform is playing an influential role in transforming their lives. For example, several participants shared that the platform connected them with blind participants in other states and far-off locations. They deeply valued the interactions with other blind participants and derived several benefits by using the platform. For many of them, our voice forum was their first introduction to a social media platform.

Using this platform is a great experience. I listen to great people from all over India, made many new friends, and heard many creative talents of other blind people. In this fast life, no one has time to listen to jokes, songs, and one-liners. Those who have time, don't have resources. Those who have resources, they don't have time. Now a days, literate, illiterate, poor, rich everyone has a mobile phone. The platform has enabled those who don't have resources to consume entertaining content anywhere, anytime, and in any quantity.

U1 (Male, Telephone operator, 31 years, Maharashtra)

Many participants perceived the forum to be exclusively designed for and used by low-income blind people, primarily because of the sheer number of them on the voice forum and the presence of abundant songs, poems and discussions central to visual impairment. For example, our analysis revealed three songs on the importance of Braille and a discussion on Louis Braille. Blind people used the platform to meet new people and earn social capital. Many participants also exchanged their phone numbers by recording a message on the platform for having longer offline conversations with other users on the platform.

The platform is a boon for blind people. It gives us the opportunity to show and improve our talent. Blind people who use the platform are very competitive and they continue to improve their messages. We also reach out to people in far-off towns and get to know them better. We get a lot of knowledge. I also get inspiration from listening to other blind people. Blind people who want to learn and make progress share informative messages with us.

U2 (Male, High school student, Uttar Pradesh)

We were curious to understand how blind participants heard about the voice forum. Many participants reported that they were told about the platform either by a friend or a teacher. Several participants spread information about the platform by calling their friends. During the qualitative interview, one participant reported receiving a phone call from a friend to say thank you for introducing him to the platform: “*You have given me a new life. The platform is very good.*”

The participants were excited that their messages were reaching to people all across India. When asked who according to them listen to the messages on the platform, many participants responded that “*literate, knowledgeable and inquisitive folks*”, people of all generations listen to it: “*mothers, sisters, kids, old, government workers, officers, students, farmers, everyone listens.*” The participants treated the community to share personal stories and accounts of life. We also found several messages where blind people recorded their children singing a song or a poem.

The participants regarded the platform as an avenue to access entertainment, share information and learn skills. Many participants perceived it as a platform to show, judge and share feedback on musical talent. Five people believed that the platform is developed by *The National Academy of Music, Dance and Drama* and the Government of India to provide opportunities for low-income blind musicians. In addition to deriving entertainment from the platform, several participants also learnt about and discussed current national and regional news. Several people recorded performances and news on the 2013 North India floods.

Whatever I say about this platform will not be enough. We hear good jokes, songs, poems and even useful knowledge. We listen to the important news of India and world. We also got to know the latest situation of North India floods on the platform.

U3 (Male, High school student, 18 years, Gujarat)

Many participants felt comfortable recording their career goals, aspirations and vision. They used the voice forum as a venue to motivate people for fighting corruption and violence, and serving the underserved communities.

I want to become a good man and fight corruption in India. Some people are using violence against women,

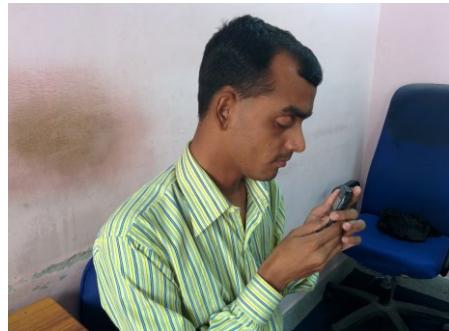


Figure 4. A blind participant accessing the social media voice forum

killing the innocents, depriving the poor of the dignity. When will this end? It will end when we decide to become righteous and law-abiding citizens. We are the future, we have to make our country successful.

U4 (Male, Student, 15 years, Jharkhand)

Many blind participants derived instrumental benefits from the social media voice forum. Several participants reported learning social skills by using the platform. An eighteen-year old student from a small city in Madhya Pradesh reported that he “*learnt how to speak properly, how to behave, and how to respect others*” by observing the interactions of other participants. Several people reported that the platform has improved presentation of their thoughts, refined the grammar and accent, and helped them learn new vocabulary. They attributed the platform for the increase in their self-confidence.

The platform has provided me a lot of self-confidence. I can learn anything from the platform. I learn a lot from general knowledge questions asked on the platform. It is a great way to learn and understand principles of life. No matter how much I praise, it will never be enough. We get entertainment and knowledge. We also learn how to record better messages. The platform gives me a lot of pleasure and knowledge.

U5 (Male, High school student, Orissa)

The social media voice forum provided more accessible venues for women and young girls for accessing information and entertainment. A fifteen-year old female student from a small town in Uttar Pradesh found the platform to be better than Facebook and Twitter. She found the content on the platform to be knowledgeable and informative. The platform provided her a gateway to create new friends without the need to go to a cybercafé: “*It is a great knowledge tool. We get to know more people and more people get to know me. It is way better than Internet, Facebook and Twitter because we can use it without spending money. We can chat, listen to messages, understand them and learn from them.*”

We found twenty-two messages containing abusive content. Many participants reprimanded those who recorded abusive content. Twelve blind participants complained about the abusive content on the forum during the phone survey: “*Abusive messages should not be played. It causes pain in our heart. Please note the phone number of people who record abusive content and warn those who are misusing the service. It is a true adage that one bad fish can spoil the whole pond.*”

The platform was successful because it could be accessed using any phone without the need of Internet connection. It provided several useful features like voice chatting, voting, and content sharing. As voice is a natural and accessible medium, it was usable by technologically inexperienced blind people. The language of the system was in Hindi and it alleviated the challenges blind people face with the language and accent of screen reading software. Because the voice forum was a toll-free line, even the poorest of the poor could also use it. It enabled several uneducated and unemployed blind people to create their own India-wide social network: *"I come from a village where it is very difficult to get educated. I want to thank you sincerely because you enabled all blind people in India to get to know each other."*

Only a fraction of all events (*playback, vote, share, record*) were *share* events. Primarily, because the sharing of content required participants to read and send SMS. In our formative study, we observed that various participants either remember the phone numbers of their friends or write it on a Braille paper. In the next iteration of the social media voice forum, we propose to provide a functionality where a user enters the phone number of a friend to share the message rather than forwarding an SMS. Once a valid phone number is entered, the friend will receive a call and the voice message will be played. It is also worth exploring the use of acoustic quick response codes for sharing the call position in an IVR tree with other participants [22]. The technique uses remote generation and recognition of audio codes and require setting-up additional servers for running it.

The participants also shared suggestions for improving the design of the platform for future deployments. Many participants requested the functionality to send personal messages to a specific participant. Some participants wanted a discussion forum functionality where they could record replies to the messages while listening to them. We plan to include these functionalities in our next iteration of the social media platform.

5. DISCUSSION AND CONCLUSION

In this paper, we have presented a detailed analysis of social media use and non-use by low-income blind people living in rural and peri-urban India. We have explored several strengths and weaknesses of Facebook, Twitter and WhatsApp for them. We found that though participants derive several instrumental benefits and gain entertainment by using these platforms, several socioeconomic barriers, limited English language proficiency and constrained access to computing devices impede the widespread adoption of these platforms. We highlighted the need to design new media technologies that are cognizant of the constraints of blind people in low-income settings. We also presented the detailed analysis of how low-income blind people adopted a social media voice forum that was not originally designed for them. The platform spread rapidly among low-income blind people in India without any marketing effort and enabled them to make new connections, showcase their talent and learn information.

Though we demonstrated the strong potential of the social media voice forum for providing information, instrumental benefits and entertainment to low-income blind people, financial sustainability of such voice forums is still a concern. A limitation of our work is that we provided the service for free. Future work is needed to figure out how to make such systems financially sustainable. Many participants in the formative study expressed concerns over higher unemployment rate and were desperate to get a job because of severe financial constraints. Previous studies have also

indicated several challenges and discriminations blind people face before and after getting employed [18]. We are presently researching the potential of using crowdsourcing on basic phones for providing additional earning opportunities to blind participants and subsidize their cost of participation on the social media voice forum through crowd work.

We observed that a majority of the contributors were male blind participants. The user analysis also revealed that only 7% of the participants were female. Some of the female participants were highly engaged with the system. One female participant, a teacher by profession, recorded fourteen songs, poems and contributed messages to several discussions. There were several messages on the platform offering special attention and adulation to female participants. Many male blind participants also asked their phone numbers for having offline conversations. Though there were several discussions on the voice forum for discouraging people to embarrass female contributors, there is a need to make both offline and online social media platforms more inclusive of low-income blind women.

One of the participants in our formative study suggested merging offline voice-based social media platform with the online social media platform like Facebook and Twitter: *"Could you design a system where we can press 1 to access Facebook, press 2 for Twitter. Can we leave a message in a voice that can be uploaded on Facebook and get translated into text?"* Though his requirements are partly supported by existing tools like IVR Junction [34], there is a need to better integrate these platforms for providing a global reach to users and facilitate seamless interactions between the global population.

One of the instructors expressed concern on the longevity of social media voice forum. He believed that such platforms will become obsolete when smartphones and Internet becomes pervasive. He argued that blind people who have access to smartphones, use the audio output of a screen reading software to check phone balance rather than using the IVR feature. We believe that our work has longevity. Even when people will have smartphones, they will continue to use voice as a dominant communication medium. For example, voice features of smartphone applications like WhatsApp, Viber, and Skype are very popular among the present Internet population.

It is worth mentioning that many low-income blind participants either did not know about piracy or they didn't care about digital right infringement (DRM). A majority of the participants in the formative study did not know about the cost of screen reader software. Only one user bought screen reader software for USD 50 from a non-profit organization. All other participants were using a cracked copy of the software. Many recent adopters planned to either download it or ask a copy from friends and instructors. The pervasive piracy of screen reader software in India is also reported by other researchers [13]. Even in our voice-based social media platform, we received many messages where participants recorded songs from other playback devices without caring about DRM.

The instructors, facilitators and many participants were enthusiastic about the promise of new media technologies in providing them information and strengthening their social connections. Several participants were learning a computer to gain social acceptance. Many participants stated that they are living in a technological era and the road to success is difficult without learning information technology. Not everyone was excited about technology, one participant expressed concern about the overuse

of technology: “*We survive because of our other senses. We should be less dependent on technology and more on our senses.*” Several participants exhorted the research community to improve existing technologies for blind people and design new media technologies that are more cognizant of their economic, social and infrastructural constraints.

6. REFERENCES

1. Agarwal, S.K., Kumar, A., Nanavati, A.A., and Rajput, N. User-Generated Content Creation and Dissemination in Rural Areas. *Information Technologies and International Development* 6, 2 (2010), 21–37.
2. Bosch, T. Young women and ‘technologies of the self’: Social networking and sexualities. *Agenda* 25, 4 (2011), 75–86.
3. Bosch, T.E. Using online social networking for teaching and learning: Facebook use at the University of Cape Town. *Communication* 35, 2 (2009), 185–200.
4. Brady, E.L., Zhong, Y., Morris, M.R., and Bigham, J.P. Investigating the Appropriateness of Social Network Question Asking As a Resource for Blind Users. *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*, ACM (2013), 1225–1236.
5. Burke, M., Kraut, R., and Williams, D. Social Use of Computer-mediated Communication by Adults on the Autism Spectrum. *Proceedings of the 2010 ACM Conference on Computer Supported Cooperative Work*, ACM (2010), 425–434.
6. Ellison, N.B., Steinfield, C., and Lampe, C. Connection Strategies: Social Capital Implications of Facebook-enabled Communication Practices. *New Media & Society*, (2011), 1461444810385389.
7. Fuglerud, K.S., Tjøstheim, I., Gunnarsson, B.R., and Tollesen, M. Use of Social Media by People with Visual Impairments: Usage Levels, Attitudes and Barriers. *Proceedings of the 13th International Conference on Computers Helping People with Special Needs - Volume Part I*, Springer-Verlag (2012), 565–572.
8. Grover, A. and Calteaux, K. A voice service for user feedback on school meals. *ACM DEV*, (2012).
9. Gulaid, M. and Vashistha, A. Ila Dhageyso : An Interactive Voice Forum to Foster Transparent Governance in Somaliland. *Proceedings of the Sixth International Conference on Information and Communications Technologies and Development*, (2013), 13–16.
10. Koradia, Z., Aggarwal, P., Seth, A., and Luthra, G. Gurgaon Idol: A Singing Competition over Community Radio and IVRS. *Proceedings of the 3rd ACM Symposium on Computing for Development*, ACM (2013), 6:1–6:10.
11. Lampe, C., Wohn, D.Y., Vitak, J., Ellison, N.B., and Wash, R. Student use of Facebook for organizing collaborative classroom activities. *International Journal of Computer-Supported Collaborative Learning* 6, 3 (2011), 329–347.
12. Mäkinen, M. and Kuira, M.W. Social Media and Post-election Crisis in Kenya. *The International Journal of Press/Politics* 13, 3 (2008), 328–335.
13. McCarthy, T., Pal, J., Marballi, T., and Cutrell, E. An Analysis of Screen Reader Use in India. *Proceedings of the Fifth International Conference on Information and Communication Technologies and Development*, ACM (2012), 149–158.
14. Mudliar, P., Donner, J., and Thies, W. Emergent Practices Around CGNet Swara, Voice Forum for Citizen Journalism in Rural India. *Proceedings of the Fifth International Conference on Information and Communication Technologies and Development*, ACM (2012), 159–168.
15. Nemer, D. Online Favela: The Use of Social Media by the Marginalized in Brazil. *Information Technology for Development* 0, 0 (2015), 1–16.
16. Pal, J. Banalities Turned Viral Narendra Modi and the Political Tweet. *Television & New Media* 16, 4 (2015), 378–387.
17. Pal, J., Gogineni, Y., Sanghavi, K., et al. Local-language Digital Information in India: Challenges and Opportunities for Screen Readers. *Proceedings of the Fifth International Conference on Information and Communication Technologies and Development*, ACM (2012), 318–325.
18. Pal, J. and Lakshmanan, M. Assistive Technology and the Employment of People with Vision Impairments in India. *Proceedings of the Fifth International Conference on Information and Communication Technologies and Development*, ACM (2012), 307–317.
19. Pal, J., Pradhan, M., Shah, M., and Babu, R. Assistive Technology for Vision-impairments: An agenda for the ICTD Community. *Proceedings of the 20th International Conference Companion on World Wide Web*, ACM (2011), 513–522.
20. Pascolini, D. and Mariotti, S.P. Global estimates of visual impairment: 2010. *British Journal of Ophthalmology* 96, 5 (2012), 614–618.
21. Patel, N., Chittamuru, D., Jain, A., Dave, P., and Parikh, T.S. Avaaj Otalo: A Field Study of an Interactive Voice Forum for Small Farmers in Rural India. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2010), 733–742.
22. Pearson, J., Robinson, S., Jones, M., Nanavati, A., and Rajput, N. ACQR: Acoustic Quick Response Codes for Content Sharing on Low End Phones with No Internet Connectivity. *Proceedings of the 15th International Conference on Human-computer Interaction with Mobile Devices and Services*, ACM (2013), 308–317.
23. Rangaswamy, N. and Cutrell, E. Local Pocket Internet and Global Social Media: Facebook and Youth Sub-Stratum in Urban India. *IFIP 9th International Conference on Social Implications of Computers in Developing Countries*, (2013).
24. Raza, A.A., Ul Haq, F., Tariq, Z., et al. Job Opportunities Through Entertainment: Virally Spread Speech-based Services for Low-literate Users. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2013), 2803–2812.
25. Shirky, C. The Political Power of Social Media: Technology, the Public Sphere, and Political Change. *Foreign Affairs* 90, 1 (2011), 28–41.
26. Solis, B. The Social Revolution is Our Industrial Revolution. <http://www.briansolis.com/2008/07/social-revolution-is-our-industrial/>.
27. Starbird, K. and Palen, L. “Voluntweeters”: Self-organizing by Digital Volunteers in Times of Crisis. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2011), 1071–1080.
28. Starbird, K. and Palen, L. (How) Will the Revolution Be Retweeted?: Information Diffusion and the 2011 Egyptian Uprising. *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*, ACM (2012), 7–16.

29. Stefanone, M.A., Kwon, K.H., and Lackaff, D. Exploring the relationship between perceptions of social capital and enacted support online. *Journal of Computer-Mediated Communication* 17, 4 (2012), 451–466.
30. Tsaoousides, T., Matsuzawa, Y., and Lebowitz, M. Familiarity and prevalence of Facebook use for social networking among individuals with traumatic brain injury. *Brain Injury* 25, 12 (2011), 1155–1162.
31. Vashistha, A., Brady, E., Thies, W., and Cutrell, E. Educational Content Creation and Sharing by Low-Income Visually Impaired People in India. *Proceedings of the Fifth ACM Symposium on Computing for Development*, ACM (2014), 63–72.
32. Vashistha, A., Cutrell, E., Borriello, G., and Thies, W. Sangeet Swara: A Community-Moderated Voice Forum in Rural India. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, ACM (2015), 417–426.
33. Vashistha, A. and Thies, W. *IVR Junction: Building Scalable and Distributed Voice Forums in the Developing World*.
34. Vashistha, A. and Thies, W. IVR Junction. www.ivrjunction.org.
35. Wentz, B. and Lazar, J. Are Separate Interfaces Inherently Unequal?: An Evaluation with Blind Users of the Usability of Two Interfaces for a Social Networking Platform. *Proceedings of the 2011 iConference*, ACM (2011), 91–97.
36. WHO. *Factsheet on Visual impairment and blindness*. 2013.
37. Willis, D. Narendra Modi, the Social Media Politician. *The New York Times*, 2014. <http://www.nytimes.com/2014/09/26/upshot/narendra-modi-the-social-media-politician.html>.
38. Wu, S. and Adamic, L.A. Visually Impaired Users on an Online Social Network. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2014), 3133–3142.
39. Wyche, S.P., Forte, A., and Yardi Schoenebeck, S. Hustling Online: Understanding Consolidated Facebook Use in an Informal Settlement in Nairobi. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM (2013), 2823–2832.
40. Wyche, S.P., Schoenebeck, S.Y., and Forte, A. “Facebook is a Luxury”: An Exploratory Study of Social Media Use in Rural Kenya. *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*, ACM (2013), 33–44.
41. Social Media: The Biggest Shift Since The Industrial Revolution. *Social Factor*. <http://socialfactor.com/social-media-the-biggest-shift-since-the-industrial-revolution/>.
42. BBC Nepali earthquake lifeline public chat channel launches on Viber. <http://www.bbc.co.uk/mediacentre/latestnews/2015/bbc-nepali-viber-launch>.
43. Voxeo Prophecy Platform. <http://voxeo.com/prophecy/>.
44. CGNet Swara. <http://cgnetswara.org/>.