

# Challenges and Issues Integrating Smartphones into Teacher Support Programs in India

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## ABSTRACT

Current ICTD best practices call on practitioner organizations that deploy technology interventions with marginalized communities to commit to long-term engagements and provide continuous support. This paper describes a qualitative study that examines the challenges and issues that arise for organizations that have tried to answer this call: a set of education-focused non-profit organizations in India that have invested heavily in building long-term relationships with low-income schools and that are deeply committed to providing ongoing support, both in-person and via technology. Interviews and observations with 71 participants (51 from eight organizations, and 15 teachers and five principals from 12 schools) reveal (1) the challenges and issues that arise as organizations integrate smartphones into teacher support programs, and (2) the strategies that teachers and organizations use to ease smartphone adoption in teacher support programs. Our findings uncover the effects of organizations' smartphone-oriented support programs on teachers' workloads, efficacy, and stress, and highlight opportunities for organizations to improve their programs and support structures.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

## KEYWORDS

HCI4D; ICTD; education; teacher support; smartphone; non-profit; practitioner organizations; India

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## 1 INTRODUCTION

The ICTD community has long recognized the important role that organizations, both NGOs and social enterprises, play in the long-term success or failure of technology interventions [25, 26, 42, 69]. In the education domain, in which our work is situated, a robust body of research has examined the development and deployment of specific technological interventions [9, 21, 23, 37, 41, 68]. When describing what it might take for such projects to be scaled or sustained, researchers frequently point out the need for long-term, continuous support that is provided by local organizations familiar with the context and communities in which the technology is being deployed [69]. Our paper forwards this conversation by examining the benefits, challenges, and tensions created by organizations that have answered this call. Specifically, we focus on a set of education-focused non-profit organizations in India that have worked to build long-term relationships with low-income schools and that are deeply committed to providing ongoing support, both in-person and via technology.

We conducted a qualitative study in India with 71 participants: 51 from eight organizations, as well as 15 teachers and five principals from 12 low-income schools. These organizations view smartphones as a tool to *augment* their primary in-person support initiatives rather than substitute them. We find that the multipurpose nature of smartphones means that different stakeholders have conflicting opinions and receive contradictory directives about the appropriateness of using smartphones at school, with state governments and school leadership worried that smartphones will distract teachers from their duties, while organizations encourage teachers to use smartphones, both inside and outside the classroom.

For the most part, organizations require that teachers use their personal smartphones for these programs, which leads to challenges for teachers who do not own a phone or who share a phone with family members. Using personal devices for work also creates tensions stemming from teachers increasingly being expected to be available online after work hours, potentially adding to their already overburdened workloads.

We also discovered a mismatch between organizations' expectations regarding teachers' knowledge of how to use their smartphones and teachers' actual knowledge, with support programs often focusing heavily on the pedagogical aspects of their programs and not on training teachers how to troubleshoot common technical problems. As a result, much of the time that organization staff spend providing support in-person is focused on solving technical

problems. Thus, to complement their in-person support, many organizations have developed programs that they deliver via social media to engage teachers in pedagogical discussions.

Our findings expand the ICTD community's knowledge of the role played by organizations that seek to aid marginalized communities via sustained engagement and long-term support programs. We show how organizations are in a good position to help mould the community's mindset about the role of smartphones as productive tools for teachers' work, but doing so would require improved coordination of activities and more consistent messaging. In addition, we find that it is crucial to pay close attention to how technology-based programs might add to teachers' workloads, force them to work outside of work hours, and increase stress and anxiety. Finally, we show how the social-media based support programs created by organizations may provide valuable online communities of practice [45] that aid teachers professional growth.

## 2 BACKGROUND AND RELATED WORK

A rich body of literature in ICTD has studied technology-supported education in low-resource communities, with a recent survey of the HCI4D literature finding that education is the most prevalent research domain in HCI4D [16]. Many projects focus on designing or deploying technology interventions that target students, both in classrooms (e.g., [7, 71]) and outside of them (e.g., [47, 57]). One famous early example is the One Laptop Per Child (OLPC) project that aimed to deliver low-cost laptops to millions of children in the hope that they would teach themselves how to use the technology [41]. Following the failure of many OLPC-focused projects [8, 21, 76], Toyama discussed how technology is pointless if it is not accompanied by strong support and effective training for teachers [69] and several projects have subsequently worked with both teachers and students to deploy digital technologies with better outcomes [23, 68].

Several interventions have focused on improving the quality of instruction by connecting low-skilled teachers in rural areas with expert teachers via video-based content [9, 60]. Another cluster of studies have specifically examined the motivations of teachers in low-resource schools and the challenges that they face. Heeks and Krishna find that teachers want to learn new skills, if given proper support, to improve their social standing [32]. Vishwanath et al. [74] study teachers' use of online teaching systems, uncovering linguistic, training, and cultural challenges that impacted teachers' willingness to use technology. A recent study by Varanasi et al. [73] examines how a teacher-focused technology intervention impacts teachers' work practices, including preparation, teaching, and administration in low-income settings. Another set of interventions aim to help teachers plan and deliver content [37, 53, 55, 72].

Although many of these prior interventions and projects have partnered with non-profit and/or practitioner organizations, there is a need for research that examines how such organizations promote the integration and use of technology within their school and teacher support programs, the impact of technology on the relationships and interactions between organizations and teachers, and the effects of technology-oriented programs on teachers' workloads, efficacy, and stress.

The ICTD community has long recognized the important role that organizations (both NGOs and social enterprises) play in determining a project's impact on the ground [25, 26, 42, 69]. For example, Gitau and Marsden [26] point out how locally-situated organizations often have a strong understanding of a community's culture and attitudes, resulting in increased sensitivity to the social, political, and cultural challenges that community experiences. Consequently, these organizations are in a perfect position to potentially adapt technology interventions to better suit such dynamic stakeholders and their ever changing contexts [19]. Several studies have also discussed the challenges that organizations face working in ICTD contexts and proposed interventions to improve organization efficiency and work practices [17, 31, 34, 65, 75]. Other projects have highlighted the value of strong organization support programs in domains across ICTD, including education [35, 66, 69, 70], health [43], Internet access [46], micro-finance [18], and agriculture [24].

Most of this prior work calls for organizations to focus on long-term engagement with communities and to provide ongoing support programs. Our paper moves this conversation forward by uncovering the challenges and issues faced by organizations that have tried to answer this call; organizations that have invested heavily in building long-term relationships with schools and that are deeply committed to providing ongoing support, both in-person and via technology. We focus specifically on education-focused non-profit organizations in India and, rather than focusing on only a single organization or intervention, we engage with a variety of different organizations that work with schools who serve low-income communities (both government and affordable private schools). Collectively, these organizations deliver a range of technical and non-technical interventions and teacher support programs.

Our work takes place in India within a rapidly-changing and evolving technological landscape [50]. In the last few years, two important shifts have made it feasible for teachers in low-income schools in India to own and use mobile devices. First, there has been an exponential inflow of cheap smartphones into the Indian market from Chinese and local manufacturers [50]. Second, the launch of the Reliance Jio LTE service in 2016, which gave free SIM cards to anyone with access to Aadhaar (India's biometric ID system), has led to drastically reduced cost of mobile data [51]. For example, subscribers currently pay ₹199 per month (US\$2.30) for 42GB data, after which they receive unlimited 3G or 2G data. This is roughly a third of what data cost two years ago.

## 3 METHODOLOGY

Our IRB-approved qualitative study took place over six months in two states in India, Karnataka and Telangana. We conducted observations and interviews with organization staff members as well as school teachers and principals to answer the following research questions:

**RQ1:** What challenges and issues arise as organizations integrate smartphones into teacher support programs?

**RQ2:** What strategies do teachers and organizations use to ease smartphone adoption in teacher support programs?

To obtain diverse perspectives on how smartphones impact teacher support programs, we included participants from eight

<b>Teach for All</b> (founded 2006): To build a movement of leaders to eliminate educational inequity
<b>Meghshala</b> (founded 2014): Create a way to turn teachers into Master Teachers, and shrink the teacher skill deficit
<b>EkStep</b> (founded 2015): Create equitable access to learning opportunities for children in the primary years
<b>321</b> (founded 2012): Empower schools with a two-year teacher training and school strengthening program
<b>India School Leadership Institute (ISLI)</b> (founded 2013): Developing the skills of school leaders to drive excellent outcomes from underserved schools in India
<b>iTeach</b> (founded 2015): Establish a chain of affordable private schools for India's poorest students
<b>Akanksha</b> (founded 1990): Provide school reform to deliver a high-quality education to each child, no matter his or her background
<b>Mantra4Change</b> (founded 2013): Build a strong school culture that promotes effective teaching-learning processes

**Table 1: Organizations and their mission statement.**

organizations and 12 schools. In total, we had 71 participants: 51 organization staff, 15 teachers, and five principals.

Our team consisted of four researchers (one woman and three men): two are Indian, one African, and one is from the U.S. but of Indian descent. All four researchers are affiliated with a U.S. university. All fieldwork was done by the first author, a Ph.D. student, whose foreign education would likely have placed him in a position of power relative to study participants, especially those from low-income schools.

### 3.1 Organizations and Schools

Table 1 summarizes the eight organizations in our study and their high-level mission statements. Most of the organizations were founded within the last decade and aim for multi-year engagement with schools as they work to develop and sustain a range of learning, pedagogical, and managerial support programs. These organizations use different models to support teachers. For example, Akanksha [5] and iTeach [14] run their own schools by re-purposing unused space in government schools, with the goal of expanding the government education system that stops after the seventh grade in some Indian states. Mantra4Change [48], on the other hand, provides systematic support to already established schools, including needs assessment, new structures to improve school functioning, and creating community awareness. Rather than focusing on an entire school, ISLI [38] takes a top-down approach, targeting school leadership and management (e.g., principals or head teachers), thereby indirectly impacting teachers. Several other organizations (e.g., Teach for All [22], Meghshala [49], EkStep [20], 321 [1]) focus mainly on teachers. Teach for All trains graduates from top universities in India to become *fellows* that spend two years as full-time teachers in a low-income school working closely with local teachers. All organizations use smartphones to augment their existing educational support programs that are carefully crafted using pedagogical principles.

Finally, organizations' objectives and programs often overlap, sometimes placing them in the same schools in parallel, working with different stakeholders.

We selected 12 low-income schools—both government and affordable private schools—that work with one or more of the eight

organizations. These schools follow a similar curriculum, use English as the language of instruction, and evaluate students via exams. Private schools and government schools differ on how they are managed and funded. Private schools often hire teachers on a short-term contract whereas government school teachers are full-time employees funded by the state. Private schools pay teachers substantially less and offer less professional development training compared to government schools. Teachers in both types of schools are often overloaded with teaching and administrative responsibilities. While private school teachers are expected to work after school hours to conduct extra teaching, government school teachers are swamped with administrative duties, such as compiling midday meal reports, responding to government circulars, conducting surveys, and monitoring local elections.

### 3.2 Field Observations

We conducted a total of 66 hours of in-school observations over a one month period with staff from two organizations, Meghshala and Teach for All. We examined how they interact with teachers and integrate smartphones into teacher support programs. We recruited participants through our on-going research relationships with these organizations and observed them as they went about their daily work in schools. We also observed teachers in these schools for 11 hours to understand their participation in teacher support programs.

Meghshala provides pedagogical support to teachers through a custom-designed app combined with on-the-ground support. We shadowed Meghshala staff as they went about their duties for roughly four hours per day, including school visits to provide in-person support, troubleshoot technical problems, and answer questions. By contrast, Teach for All provides support via *fellows* who perform the same job as teachers. Thus, our observations with these participants were the same as for teachers: we followed them as they conducted their duties in classrooms, staff rooms, during lunch, after-school meetings with management, casual meetups, and group discussions.

In total, we observed 20 organization staff and ten teachers at eight schools in Karnataka and Telangana. Throughout our observations, we asked contextual and spontaneous questions to gain deeper understanding. We collected detailed notes and recorded audio (with permission) for further analysis.

### 3.3 Semi-structured Interviews

After completing our observations, we used snowball sampling [27] to recruit interviewees. We asked our contacts at Meghshala and Teach for All to introduce us to other organizations and schools that we then invited to participate.

We interviewed staff at their offices, and teachers and principals at their school. We began with a brief explanation of our research and then asked questions to understand participants' roles and demographic characteristics, the role played by smartphones in their work processes and interactions, and the challenges that arise when using smartphones in teacher support programs. Example questions included - "What kind of training do organizations provide to help teachers take advantage of support programs?" and "What

Organization Participants				
Participants	Observation & Interviews: 51			
Gender	Female: 25	Male: 26		
Age (years)	Min: 20-25	Max: 45-50	Avg: 25-30	
Experience (years)	Min: 1	Max: 29	Avg: 4.2	S.D: 5.0
Education	Graduate: 33		Post-graduate:18	
School Participants				
Participants	Observation & Interviews: 20			
Gender	Female: 13	Male: 7		
Age (years)	Min: 30-35	Max: 45-50	Avg: 35-40	
Roles	Teacher: 15	Principal: 5		
Experience (years)	Min: 2	Max:25	Avg: 12.12	S.D: 5.36
No. of Subjects	Min: 1	Max:3	Avg: 2	
Grades taught	Min:3	Max:5	Avg:3	

**Table 2: Summary of participants from organizations (top) and schools (bottom).**

kind of challenges do teachers face in using smartphone for the training program?” Interviews took place in a mix of English and local languages, lasted 45 minutes to two hours, and were audio recorded with permission.

In total, we conducted 41 semi-structured interviews: 31 with employees from eight organizations, and ten with school teachers and principals. All participants spoke English and about half were female. All participants had a college degree. Of the ten participants from schools, five had experience working as both teachers and principals. Our teacher participants taught an average of two subjects across three different grades, spending eight hours per day in the school. Table 2 summarizes our participants’ demographic characteristics.

### 3.4 Data Analysis

Our data consisted of audio recordings from our observations, 44 hours of interview recordings, and extensive field notes collected during observations and interviews. The recordings were translated into English (if necessary) before being professionally transcribed and analyzed using Atlas.ti. We used inductive thematic analysis [11] to analyze our data. We began by reading through the data several times to identify initial codes. The first author then conducted multiple rounds of iterative open coding to identify patterns. After each round of coding, we used peer debriefing [15] with the other authors to discuss and refine the codes. Our final codebook consisted of 49 codes. Example codes include *device ownership*, *friction*, and *smartphone literacy*. We then clustered related codes into 13 higher-level themes that we used to organize our findings. Examples of themes are *organizational support*, *device-sharing*, and *conflicting directives*.

## 4 FINDINGS

Our analysis provides insights into the challenges faced by teachers and organizations and the coping mechanisms they develop as smartphones are integrated into teacher support programs. We found that contradicting directives on smartphone use during school hours as well as issues with smartphone proficiency and sharing cause stress and anxiety to teachers, thereby debilitating teacher

support programs. Teachers are also expected to use their personal phones for work and engage via organization and school-run social media groups, which leads to expectations that teachers respond to work requests outside of work hours. We organize our findings to first present challenges and tensions that arise when smartphones are integrated into teacher support programs (RQ1, first two sub-sections) and then outline strategies that teachers and organizations use to ease smartphone adoption in teacher support programs (RQ2, last three sub-sections).

### 4.1 Conflicting attitudes about the appropriateness of using smartphones at school

Our findings suggest that the multipurpose nature of smartphone devices means that different stakeholders have conflicting opinions and receive contradictory directives regarding the appropriateness of using smartphones at work. Our conversations with organization staff revealed that school management and the state government felt that smartphones have the potential to be distractions in the classroom, thereby diverting teachers’ attention away from their work. A participant noted,

*“The government is totally against it. There are orders banning the use of smartphones in the classroom. But [teachers], not surprisingly, fail to implement it. Teachers will never publicly admit that they use phones in class. But they all use them.” (P31, Program Manager, ISLI)*

Since smartphones are a major vehicle for entertainment (e.g., watching videos and listening to songs), the higher management at many schools regularly send circulars strongly discouraging teachers from using their smartphones during work hours. A few government schools in Karnataka even directed teachers to deposit their smartphones in the principal’s office during teaching hours. At the same time, the government and school management often contradict this directive by encouraging teachers to use smartphones at work for both administrative purposes and teaching support. For example, management of the schools’ midday meal program, which aims to improve student attendance by providing a meal at school, is now done via a smartphone app instead of paper.

In addition, our analysis revealed that school management at many schools have created and make heavy use of WhatsApp groups that teachers are expected to participate in for a range of administrative and communication functions. For example, WhatsApp groups have enabled school management to save time and human resources by moving away from paper-based announcements and circulars. Previously, important logistics, administrative circulars, and other announcements were sent through physical registers to classrooms, requesting signatures and coordination. This time-consuming process is now done entirely over WhatsApp. Teachers are required to monitor these WhatsApp groups, both during school hours and outside of them, and take actions as directed.

Meanwhile, further exceptions to the “no smartphones in class” rule were made to enable teachers to use specific organizations’ apps in their work. Several school principals in Karnataka said that they have in fact made it mandatory for teachers to use a specific organization’s app. A teacher said,

*“One issue is that teachers are not allowed to use smartphones in class. This is an official rule. Normally, we cannot use it in the period ... We are only able to use it for [the organization’s app] as we got permission. Sometimes we have to give it to the headmaster, but I keep it in the bag.” (P61, Social Science Teacher, Grades 1-5)*

Indeed, our analysis revealed that all the organizations used smartphones to assist their support programs. In this sense, rather than viewing smartphones as a distraction, organizations tended to view them as essential support tools.

Interestingly, we also discovered cases where different organizations that were working in the same schools in parallel, but with different stakeholder groups, did not coordinate their activities or messages, which often led to confusion and tension. For example, ISLI is an organization that works with school principals and management, providing techniques for giving feedback to teachers and advice about essential management functions. Their programs do not include any training or mention of how to manage teachers’ use of smartphones in the classroom. At the same time and in the same schools, other organizations like 321 and Meghshala were actively training teachers to use their smartphone to support their classroom interventions. This led to tension between teachers who were being encouraged to embrace smartphones and upper management who had not received any exposure to these new smartphone-based interventions. Indeed, four out of the five principals in our study expressed uncertainty about observing, understanding, and assessing teachers’ use of smartphone devices in the classroom. As a result, principals were sometimes reluctant to endorse teachers’ adoption of smartphones, and this reluctance in turn affected teachers’ attitudes towards these devices. A participant said,

*“How open and broadminded they are in terms of accepting new methodologies, it sort of trickles down ... If the management is not in favor of technology ... or is willing to just stick with traditional methodologies, then this [attitude] trickles down [to teachers] as well.” (P28, Program Manager, Teach for All)*

Overall, our data suggests that the contradictory directives regarding whether or not teachers are allowed or encouraged to use smartphones at school result in confusion and anxiety, potentially leading to increased stress for teachers who are simultaneously required to use smartphones at work but also afraid they will get into trouble for doing so.

## 4.2 Device sharing and ownership issues impact the availability of smartphones for work purposes

As discussed above, majority of the organizations in our study ran programs that expected teachers to use smartphones as an educational tool, both at work and at home. Although there were a few instances where organizations occasionally provided devices to schools, for the most part the organizations in our study (six out of eight) required that teachers use their own, personal smartphones when participating in the organizations’ programs. However, such a model makes a number of assumptions: that teachers do indeed

own a smartphone device, that they know how to use it, that they are able to bring it to work every day, and that they have access to it at home. Our analysis showed that these assumptions often result in challenges that we now discuss.

Regarding smartphone ownership, prior literature has discussed how it is common for people in the Global South [3, 4, 12, 56, 59], and South Asia in particular [2, 64], to share a single device between multiple individuals. Our findings validate this prior work, with teachers in our study frequently sharing devices with their spouse and/or children. We also extend the literature by revealing how device sharing impacts the ways in which teachers, who are mostly women, are able to use these devices as tools for *work*. As one participant said,

*“Teachers either use ... their [own] phone, or sometimes they give the numbers of their brother, mother, or father where they go back home and use that phone. Because there are a lot of young teachers who may or may not carry these phones by themselves.” (P12, Design Manager, 321)*

We heard how, if the teacher is not the owner of the device, they were sometimes able to bring the device to school, primarily for safety and communication purposes. However, when they go back home, the device is returned to the owner (e.g., husband, sibling, parent), resulting in a lack of access at home. Even if teachers have their own device, they frequently share it with their family. In these cases, teachers typically carry their phone with them when they go to school and, while at school, they are able to use the device as needed. However, once they return home, it is very common for family members, especially their children, to take their phone and use it for playing games, watching videos, or homework. As a result, our participants described how the teachers’ opportunities to use a smartphone (e.g., for communication or preparation) may decrease when they are at home or over the weekends. These situations may prevent teachers from being able to fully participate in the organizations’ programs and inhibit their ability to receive pedagogical content through technology. To overcome this challenge, several teachers said they spend a substantial amount of time at school trying to catch up (e.g., lunch breaks, after school), which may add additional work to their already overburdened schedule.

On the other hand, teachers who did have their own smartphone reported that the amount of smartphone-based work they now do outside of school has grown substantially. This includes tasks required by organizations’ apps (e.g., lesson preparation) as well as responding to various work-oriented notifications from generic apps, such as WhatsApp. Consequently, several teachers said that they felt they were *always* online despite no longer being physically at work.

In addition to these challenges, we discovered a number of beneficial side effects that stemmed from device sharing. For example, our interviews revealed that, through their children, teachers are often exposed to new educational apps and troubleshooting techniques that they were not previously aware of. Some of these apps are introduced through programs at their own children’s schools, and teachers learnt about them when the children installed the app on the parent’s device. For example, P69 (social science teacher, grades 4-7) mentioned that this was how he was introduced to

Byju's (a popular Indian learning app) [13]. The teachers in turn share their knowledge of these new apps with other teachers and organizations, sometimes adopting them in their own teaching.

In addition to sharing devices with their own children and families, we observed that many teachers were also comfortable handing over their own personal devices to students in their class to allow the students to view and explore content on the device (see Figure 1A). For example, while explaining the concept of germination, we observed one teacher hand over her smartphone to a group of students so that they could watch a time-lapse video of a seed germinating. Another teacher described how giving the device to children prompted engagement with class material, telling us,

*"I just opened the device, loaded the content, and gave the device to the students. I asked them to look at it for a minute and then I started to explain the lesson. They immediately began to engage and tell me their opinions about the content."* (P66, Science Teacher, Grades 1–5)

### 4.3 Training teachers to use technology interventions

Having looked at how device ownership and sharing patterns impact teachers' general usage of smartphones for work, we now examine the challenges experienced by teachers and organization staff as they work to introduce and integrate technology interventions into schools. Our data shows that the organizations in our study view smartphone technologies as an important tool to help with their ultimate goal of achieving pedagogical change in low-income schools, with several (four out of eight) investing resources in building custom smartphone-based apps (e.g., Meghshala, EkStep, Mantra4Change). However, we discovered a mismatch between the organizations' expectations regarding teachers' knowledge of smartphone technologies and the teachers' actual knowledge.

Most of the organizations (six out of eight) use a model in which they conduct workshops that train teachers to use their tools (see Figure 1B). During these workshops, organizations focus mainly on pedagogical and learning topics, in part as a result of the organizations' overarching goals to achieve pedagogical change and in part due to the need for smartphones to be seen as educational tools (rather than for entertainment). At the same time, the training workshops typically require teachers to use their personal smartphones. Combining these factors, we saw how the training materials developed by organizations generally expected teachers to already possess the knowledge and experience required to handle general smartphone troubleshooting. In other words, the training materials took as a starting point, "how to use our app or platform" and not "how to use your smartphone."

However, we discovered that many teachers have limited experience using their smartphones, only interact with a few popular apps (e.g., calling, texting, WhatsApp), and often do not have the troubleshooting experience to deal with the range of technical problems that may result when using new apps or platforms on their own phones. One participant said,

*"A lot of teachers have smartphones but they don't really know how to operate it or find the right information that they want at that moment."* (P23, Manager, Mantra4Change)

We observed that many teachers struggled with common troubleshooting, such as locating downloaded files, using the 'settings' menu to force-stop a rogue instance of an app, solving problems that come up when trying to "cast" content from the phone onto a big screen, deleting files to make space for new content. However, organizations' training workshops spend almost no time training teachers to deal with these kinds of technical issues or teaching them troubleshooting skills. As a result, participants described how the training sessions can be technically challenging for teachers, and result in a need for on-going tech support, as we discuss next.

### 4.4 Strategies for sustaining technology interventions

Our analysis shows that as teachers interact with smartphone-based educational interventions in their day-to-day work, they often seek technical support from a variety of different sources. Some teachers turn to their teaching colleagues for help (see 1.C). As one relatively tech-savvy teacher said,

*"Other teachers keep on asking me, 'I downloaded a file in the [organization's] app. But, I don't know where is my downloaded file.' Things like this happen all the time ... I spend time helping with that"* (P57, Math Teacher, Grades 1–7)

Alternatively, we heard how teachers would, on occasion, ask family members to help them overcome technical hurdles. Teacher 13 described how in one workshop teachers were provided a link to resources on Pinterest, which only opened in the Pinterest app. However, the app installation failed many times, after which she sought help from her husband who troubleshooted the issue by creating enough space in the phone's memory for the app to be successfully installed.

Finally, teachers also often turn to organization staff for technical support. To support long-term engagement and sustained interventions, several organizations (five out of eight) provide continuous pedagogical support to the schools they are engaged with by physically situating or sending staff to visit the schools periodically. For example, Meghshala deploys associates to provide consistent in-person support to each school roughly every 1.5 weeks to help with teachers' preparation and teaching via their smartphone app. Although the organization staff intend to provide *pedagogical* support to teachers, in reality they mainly spend time providing technical support rather than engaging teachers in discussions and training around pedagogy. A participant noted,

*"Any technical issues like devices not working or suddenly ... the [devices] are not able to connect to the server, or any of these issues that pop up, they call me because I am the point of contact on the ground."* (P15, Associate, Akanksha)

Even with this on-going, in-person support, many teachers frequently forgot aspects of how to use the technology, resulting in a need for repeated assistance. One teacher said,

*"After downloading the video in the app, I have to watch it again for preparation. But, I don't know how to do it. [Support staff] have told me many times. But, it does*



**Figure 1: (A) Students trusted with devices in class; (B) Teachers using personal phones to learn an organization’s app in a training workshop; (C) Teacher receiving technology assistance from a peer; (D) Organization sharing Pinterest resources via WhatsApp.**

*not stay in my memory.” (P61, Social Science Teacher, Grades 1–5)*

We did hear some instances where organization staff were able to assist teachers with pedagogical support, providing feedback on lesson plans and teaching strategies. Such in-person meetings between organization staff and teachers often occurred during lunch time or after school. A participant said,

*“I usually sit down a lot with the maths teachers ... We give each other feedback on lesson plans, classes, what we teach, how we teach. This is not something that was designed or told to us, but we do it nevertheless.” (P21, Associate, iTeach)*

However, both parties have tightly-packed schedules and it can be difficult to find opportunities for these in-person interactions. Thus, teachers and staff have steered towards social media apps (e.g., WhatsApp) for such discussions. We observed cases where teachers used WhatsApp to take a picture of a lesson plan they wanted feedback on or recorded audio about a problem they were facing and sent it the organization’s associate for feedback or a solution, making it easier for staff to respond in their own time. One participant said,

*“A teacher found it hard to teach maths ... she would write the math problem on the chalkboard, take a photo and then would ask me, ‘Sir, how to do?’ ... I would use a whiteboard ... solve it in two or three steps, take photos of that, and send it back to her. Sometimes, she would send me back a photo of her actually having done it in class. This was not something I directed, it was her initiative.” (P24, Implementation Manager, Meghshala & Fellow, Teach for All)*

Our analysis suggests that these organic WhatsApp-based interactions are a very important support structure that enable teachers to discuss classroom strategies and pedagogical challenges with organization staff as they arise. We now discuss how several organizations developed more formalized structures for providing support via social media applications.

#### 4.5 Organizations’ use of social media

In recognition of the struggle to provide teachers with technical support and engage them in pedagogy-related discussions, several organizations (Teach for All, Akanksha, 321, Megshala, iTeach, and Mantra4Change) have converged on a common strategy in which they use popular, off-the-shelf social media applications (e.g., WhatsApp, YouTube, Pinterest) to complement their in-person support programs. Staff from 321 and Mantra4Change discussed how their organizations postponed or entirely dropped the idea of developing custom apps. Instead, these organizations are focusing their strategy on popular applications that teachers already use.

For example, staff from Mantra4change described how they designed a set of YouTube videos containing relevant content and pedagogical training for teachers that is closely linked to their local classroom challenges, such as finding resources and classroom management techniques. They said how “making pedagogical content accessible via platforms that teachers already use and are comfortable with” is a useful way to promote use of their tools.

Several other organizations introduce new platforms to teachers by posting links via familiar platforms. For example, we saw resources posted via WhatsApp that linked to Pinterest, Twitter, and community podcasts that are prominent among teachers in Western settings. We learned that organizations share these apps to support specific aspects of teachers’ work. For instance, Pinterest was frequently shared by 321 and Akanksha staff via WhatsApp and in-person interactions to help teachers explore classroom materials. Pinterest is a popular app where teachers design and ideate several ideas around support materials for the classroom and share it on the platform [28]. Figure 1.D shows one such example where organization staff from 321 shared a Pinterest resource around different classroom ‘rules’ by creating innovative posters and sticking them up in the classrooms. This resource was originally shared on Pinterest by a teacher in a Western setting.

However, out of all the apps, our analysis revealed WhatsApp as the most widely-used tool. Although there are variations in usage due to different device ownership models (discussed previously),

all participants, including teachers, had at least some access to WhatsApp. One participant described,

*“Even though the teachers struggle to use our resources, they are very comfortable using the WhatsApp groups ... Nowadays we see teachers watching videos of 10MB. Earlier the challenge was to solve their access to these resources. Now it has become easier for them.” (P19, Consultant)*

Several participants also noted how teachers conversed openly on WhatsApp groups in local language (typed in English script), in contrast to reluctant in-person participation with staff and colleagues where they are often pushed to speak in English. The staff member noted,

*“An interesting aspect is that teachers generally struggle to speak out... but when they write messages in WhatsApp groups, they converse quite a lot in Hindi but write it out in English. It is something like WhatsApp English.” (P19, Consultant)*

In addition to using WhatsApp for organic interactions between organization personnel and teachers, most of the organizations in our study (Teach for All, Akanksha, 321, Megshala, iTeach, and Mantra4Change) have created dedicated WhatsApp groups to scaffold their support programs and communications with school stakeholders. The interactions that take place on these groups are driven mainly by organization staff members who send messages designed to motivate teachers to adopt new classroom activities and pedagogical techniques, and encourage them to become content generators by also posting about their experiences on the WhatsApp group. For example, one teacher described his experience with an organization's WhatsApp group as follows,

*“I have written many times in the WhatsApp group. Two months back, I had asked for details about how I can use a graph. After learning that, I mentioned places where graphs could be added. I also sent an example of a graph construction video to show how these kinds of videos can be added.” (P68, Math Teacher, Grades 1–5)*

Three organizations have tightly integrated WhatsApp into their official training and support programs. For example, a manager at 321 described how the organization has created an entire WhatsApp-based digital support module that aims to make teachers feel supported and appreciated via WhatsApp group conversations. Along with 321's in-person workshops and coaching modules for teachers, the trainers personally interact with teachers on WhatsApp several times a week. Design managers at 321 carefully craft the content that is sent over WhatsApp to generate positive perceptions of self-worth and motivation, with the goal of engaging teachers.

Despite the ubiquity of WhatsApp, our findings show how the platform also presents challenges. One problem is that teachers often belong to multiple WhatsApp groups, both for organizations and their school. Teachers receive many messages and resources that often pile up in their download folder or get lost in the myriad of all the other messages. Several teachers (N=6) shared how they need to revisit such materials multiple times and often end up wasting a lot of time accessing the WhatsApp media folder or searching within their messages to find specific items, which is frustrating.

For example, teacher 13 reenacted how she wasted a substantial amount of time the previous night searching for an important circular that she had downloaded from her school's WhatsApp group. She had trouble retrieving the file via the media gallery or by manually scrolling through the group messages, since the group was quite active (60+ messages/day; 200+ group members). The piling up of content also often resulted in teachers' phones running out of storage space. Most teachers owned cheap smartphones with limited memory (e.g., 8GB on average) and complained about routinely deleting WhatsApp content to make space for new content.

Facilitating engagement on WhatsApp posed several challenges for the support organizations as well. Participants described how the closed and proprietary nature of WhatsApp made it impossible for them to augment the app with their own features or bots. They also discussed how they are unable to automate the process of collecting usage data. Instead, we learned that organizations currently manually curate and collect data, such as manually counting replies and recording numbers of reactions to a post in an Excel sheet for later analysis. This manual data collection is time and resource intensive. Most organizations were aware of the 'WhatsApp for Business' app, but did not exactly know how to use it or what it offered. One organization was interested in using the 'WhatsApp for Business API' (an option catered to medium and large-scale enterprises) and submitted the application form, but their request was rejected without any explanations.

## 5 DISCUSSION

Our findings uncover a range of benefits, challenges, and tensions that result when organizations incorporate smartphones into their work with low-income schools. At a high level, all organizations recognized that technology on its own will not solve problems in education, and their programs were typically accompanied by long-term engagement combined with strong support and training to engage teachers and school leadership. This attitude is encouraging in light of past technology failures in education (like OLPC) [21, 41, 69]. Nevertheless, we uncovered opportunities for organizations to improve their programs and support structures, as we discuss.

### 5.1 Are Smartphones for Entertainment or Education?

Schumacher [61] suggests that one way to drive regional development is by creating *intermediate* and *appropriate* technological solutions. Smartphones are inherently such intermediate multipurpose devices, capable of running many different applications that provide a wide range of services. At the same time, phones and apps are appropriated for a specific purpose: to serve teachers in low-income schools.

As the presence of smartphones in schools and their accompanying support ecosystems become more prevalent, we see numerous tensions that result from the multipurpose nature of these technologies: state governments banned the use of smartphones at school while organizations encouraged their use, and school leadership would do both, often simultaneously. We also encountered schools where teachers had participated in tech-based support programs, but school principals had not received the same program and were



uncertain about integrating technology into classrooms. These mismatches led to anxiety and possible stress among teachers.

However, the organizations in our study are in a good position to help shift the community's mindset from one that views smartphones as a distraction to one that views them as productive, educational tools. Such a shift would require organizations to do a better job of coordinating their support programs, especially with other organizations that work in the same schools, to ensure consistent and coherent messaging around the role of smartphones in teaching practices.

It would also require that organizations augment their existing programs with a broader focus on training teachers and school principal to think critically about smartphone technologies and their role in teachers' work. Such a program might focus on teaching common terminology and functionality (e.g., casting content, force stopping, controlling permissions). Beyond basic functionality, such programs could train teachers to critically engage with the role that smartphones could play in their teaching, benefits and drawbacks of technology, data privacy, and more. Such programs might naturally solve the organizational problem of spending time and resources troubleshooting minor technical problems (that currently takes too much time and resources) and open up more space for pedagogical development. They could better equip teachers and principals to not only make better use of smartphones in their daily lives, but also improve their ability to introduce and integrate technology into their teaching [10, 33].

## 5.2 Personal Devices for Work: Productivity or Stress?

Prior HCI4D work has examined how employer-issued mobile phones are used by employees for personal activities, leading to both positive and negative consequences [62]. We examine the inverse: what are the benefits and tensions that arise when personal devices are used as work instruments?

Our findings show that most organizations expected teachers to use their own personal smartphones as work devices, arguing for the scalability and sustainability of this model. We found that most teachers do have direct or indirect access to a smartphone, making this a feasible model for organizations to embrace. Teachers also, on some occasions, noted the benefits of using their own phone to support their work (e.g., reviewing lesson plans at home). We also discovered new models of device sharing; for instance, we saw how teachers were comfortable sharing their personal smartphones with students to augment learning and discussion in the classroom.

However, treating personal phones as work instruments also leads to new challenges that must be navigated. For example, there is a mismatch between the troubleshooting knowledge that organizations expect teachers to have and the knowledge they actually possess, resulting in technical challenges for teachers. In addition, both installing organizations' custom apps and downloading resources sent via WhatsApp groups may lead to a lack of storage space on teachers' devices. We heard several instances of how teachers uninstalled organizations' apps due to lack of space. There are also privacy risks that result from teachers using a single device for both work and private lives, such as teachers' family viewing potentially sensitive student data, or students in the classroom

viewing teachers' private information. Teachers have also reported how higher management periodically sends additional unplanned work to their smartphones while they are at home, which may create a sense of "forced connectedness" that pushes teachers to be constantly online and to complete the required tasks outside of work hours. This may add additional stress to teachers' already burdened work lives [44, 58].

Tarafdar et al. [67] show that not all stresses around technology (*technostress*) should be treated equally or automatically associated with negative consequences. There is a clear distinction between technostress associated with creative engagement (*eustress*), which may lead to professional growth, compared to the stress due excessive workload (*distress*) that creates hindrance and professional stagnation [63, 67]. For instance, previous studies have shown peer feedback to be a great source of eustress that pushes teachers to improve their capacity in constructive ways [44]. In our study, we saw causes of both eustress and distress as smartphones are integrated into teacher support programs. For example, seeing a teacher express herself fluently in English on a WhatsApp group caused eustress to other teachers who struggled with English, whereas conflicting directives and expectation to be available outside working hours caused distress. Future research could further examine factors that cause technostress and develop tools to manage it, especially since previous studies have shown repeatedly how technodistresses negatively impact teachers' overall wellbeing [6].

## 5.3 Social Media for Supporting Teachers

Lastly, our study expands a nascent body of work that examines social media usage in educational ICTD contexts [29, 39, 40, 79]. We do this by critically analyzing how organizations integrate social media platforms into their teacher support initiatives in low-income schools. Lave & Wenger [45, 77] have shown how three elements: *domain*, *community*, and *practice*, can make it easier for teachers to participate in an online community of practice that has the potential to develop long-term growth among teachers [78]. In this sense, we saw how organizations' strategy of adopting popular tools like YouTube, Twitter, WhatsApp, and Pinterest created a community of practice and introduced new teaching ideas. We also observed how each app was used for guided development of teaching skills (*domain*) (e.g., WhatsApp was used to enable specific pedagogical discussions). New ideas were often posted or discussed by other teachers (*community*), creating an opportunity for organic interactions around these specific skills with other teachers in the community (*practice*).

It is also important to understand the different types of content that organizations shared via these platforms. Several organizations promoted resources developed in Western settings to strengthen certain aspects of teachers' work practices. For instance, Pinterest links, shared by an organization to help teachers learn classroom management, were designed by teachers in Western settings. While many underlying teaching principles have broad applicability, teachers in low-income schools in India may face additional challenges such as language translation (e.g., English to local languages), semantic localization (e.g., replacing Western names with local names), and cultural localization (e.g., adding relevant local cues). While this may manifest as a form of eustress or a challenge for teachers to

accomplish, it is important to note that these kinds of micro-tasks may add substantial distress to already burdened teachers [30, 52]. Organizations have the opportunity to further support teachers by helping them to develop contextually-relevant localized versions.

Finally, the proliferation of affordable smartphones and cheap data has prompted organizations, school administration, and teachers to rapidly adopt WhatsApp for communication, support, and engagement. Our findings show interesting emergent practices around how teachers and organizations use WhatsApp for teacher support programs. For example, many teachers perceived WhatsApp groups created by organizations as safe *communication places* [54]. Unlike their physical work lives where they are under constant pressure to perform by higher management [36], these groups provide teachers with a safe place to receive constructive feedback, ask questions about their teaching [44], experiment with new ideas, and express themselves freely. At the same time, they cause distress to teachers when the lines between work and play (and office and home) are blurred. These findings offer rich opportunities for future research that seeks an in-depth understanding of how teachers are interacting via WhatsApp groups and how new peer-support and pedagogical practices emerge in these communities of practice.

## 6 CONCLUSION

This paper examined the challenges and issues that arise as education-focused non-profit organizations in India work to integrate smartphones into their teacher support programs. Our qualitative study with 51 staff, 15 teachers, and five principals found that contradicting directives on smartphone use during school hours combined with issues related to smartphone proficiency and sharing cause stress and anxiety to teachers. At the same time, organizations and teachers developed a variety of strategies to ease the adoption of smartphones in teacher support programs. We discuss how smartphones can be used by motivated organizations to *augment* their existing support initiatives for improving teacher's productivity and wellbeing. Although we tried to balance the perspectives of both organizations and teachers, we acknowledge that the teachers we interviewed interacted with only two organizations. More research is needed to: (1) examine concrete learning gains (if any) that can be attributed to smartphone use, and (2) the extent to which our findings generalize to contexts beyond our work.

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