Care as a Resource in Underserved Learning Environments

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We present results from an ethnographic inquiry of technology-based learning at an after-school learning center in Mumbai (India) that caters to students from neighboring slum communities. We conducted participant observation for 120 hours and 58 semi-structured interviews with different stakeholders (including teachers, staff, parents, and students) at the center over nine weeks from December 2015 to July 2016. Taking an assets-based approach in an underserved context, we uncover the role of care as a resource and present the rich and varied caring behaviors enacted in this sociotechnical system. We then discuss how care effects a greater sense of *ownership*, *interdependency*, and *community*. Examining the role of aligning values in motivating caring behavior, we conclude with recommendations for supporting, leveraging, and extending care via technology design in an underserved, technology-enhanced learning environment.

CCS Concepts: • **Human-centered computing** → *Empirical studies in HCI*;

Additional Key Words and Phrases: HCI4D; ICTD; care; learning; India; qualitative

1 INTRODUCTION

Mobile penetration across the globe has grown rapidly in recent years, in response to increasingly affordable access to network connectivity and lowering costs of devices worldwide. This has fundamentally transformed the nature of interactions between individuals from historically marginalized communities and information and communication technologies (ICTs). According to the World Development Report of 2016, even among the poorest 20 percent of the so-called developing world, 70 percent have access to mobile phones, more than those who have access to sanitation or electricity in their homes [58]. In addition, over 40 percent of the globe has internet access and numerous state and industry initiatives are being launched with the aim of connecting those who are still under-connected [6, 22, 26].

With growing, affordable access to and adoption of ICTs across marginalized communities in these developing parts of the world, there are natural implications for ICT-enhanced learning in

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Proc. ACM Hum.-Comput. Interact., Vol. 1, No. 2, Article 104. Publication date: November 2017.

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these settings as well. Much prior work in the field of ICT and Development (ICTD) has examined the design of low-cost technologies for enhanced learning environments in underserved contexts [16]. A widely recognized example is that of the One Laptop Per Child project, which was extensively critiqued for a variety of reasons, although it did aim for a hardware design that was contextually appropriate [73]. The ClassmatePC project by Intel is another example, which was considered to have had relatively better integration with existing infrastructures [10]. Peña-López shifted the focus away from physical access via laptops, offering a comprehensive three-part framework for technology-based learning, which addressed infrastructures, digital skills, and content/services [57]. Much prior work in this space, we contend, adopts a deficit-based perspective, focusing on what is absent in the environment in question. Our motivation instead was to adopt an *assets-based* approach [43] to determine what resources are already present and how they might be leveraged to support learning environments in underserved contexts.

We conducted ethnographic research in 2015-2016 at Vikas, an after-school learning center in Mumbai (India). We chose this school for our research after surveying several field sites because, although it caters to students from neighboring slum communities, it also viewed technological interactions as an important aspect of the center's operations. The goal of our engagement was to examine the *assets* that might support and strengthen the design of technology-based learning environments in underserved contexts [43]. This engagement quickly drew our attention to a strong presence of care, increasingly being examined in science and technology studies (STS), computer supported cooperative work (CSCW), and human-computer interaction (HCI) research, particularly in how it involves a *"speculative commitment to neglected things"* [15]. We observed the caring interactions among the human and technological actors at Vikas in support of a sustainable, healthy, and safe environment sensitive to individual students' needs. Additionally, through interviews and workshops, we delved deeper into the values that defined a desirable learning environment and motivated enactment of care. Our findings lead us to contribute insights for how we might design to strengthen technology-based learning environments (underserved, and more generally) in ways that support, leverage, and extend care as a resource.

Our paper is structured as follows. We begin by situating our research in work that engages with the ethics of care, the role of care as studied in making, repair, and learning environments, and what it means to design with care. We then describe our field site, research subjects, and data collection methods. Next, our findings lay out the range and richness of caring behaviors we observed at Vikas and the role of technology in this ecology of care. In our discussion, we first highlight how care acts as a resource to effect a greater sense of *ownership*, *interdependency*, and *community* at the center. Then, we examine the role of underlying aligned (or misaligned) values that result in the above manifestations of care. Finally, we reflect on how technology might be designed to support the alignment of values, productively and effectively channeling care towards a stronger, if underserved, learning environment.

2 RELATED WORK

We begin by situating our research in prior work on the ethics of care and offer a contextualized definition of care. We then describe how care has been studied in relation to collaborative environments. Finally, we discuss design in relation to care, learning contexts, and educational technologies in underserved settings, highlighting our research contributions.

2.1 The Ethics of Care

The ethics of care emerged as an alternative moral system to the more male-centric ethics of *"conformity to principles"* and non-interference with individual rights [25]. According to Gilligan, the ethics of care focus more on everyone's desire and right to care about others and the outcomes

of moral decisions [25]. Tronto follows with the idea that care consists of interactions among humans, objects, and surrounding environments that promote overall well-being [69].

More recently, research has cataloged types of caring behaviors. Puig de la Bellacasa and Mol show how care comes in infinite forms, taking shape according to the situation it is displayed within [15, 50]. Puig de la Bellacasa explains the importance of asking who is caring, who is being cared about, and how care is being displayed [15]. Mol similarly emphasizes focusing on even mundane forms of care, noticing how care is not just private, spoken, or caring in a traditional sense, once again bringing up the importance of *the context* in which care takes shape [50]. Korth's categorizations of caring behavior reflect the way care takes different forms of overtness and explicitness, often in order to avoid breaking group norms [38]. Drawing on this work, we view care as ongoing interactions among the actors at Vikas (human and technological) that help promote and sustain individual and/or collective well-being, notions of which may be implicitly or explicitly defined. Heuts and Mol describe caring as *"an activity in which valuing is implied"*, adding that it *"indicates efforts that are ongoing, adaptive, tinkering and open ended"* [29]. It is these efforts that form the crux of our research; we also pay due attention to the valuing implied.

2.2 Care and Community

Moving beyond work that seeks to advance theoretical engagement with care, researchers have studied how care manifests in and supports various collaborative settings relevant to CSCW; we touch upon care in making and repair communities and learning environments.

2.2.1 Making and Repair Communities. Work in makerspaces has generally looked at care among human actors. Toombs et al. found that despite a focus on the neoliberal ethics of self-determination and autonomy within makerspaces, care pervaded the way members supported each other and created ties with the larger community [68]. In fact, Toombs et al. argue that care, even if covert, is essential to the sustenance and inclusivity of the makerspace [68]. Toombs et al. also examine interactions between researchers and study participants in makerspaces to emphasize how researchers receive as well as give care [67].

Researchers have also studied repair communities, focusing not just on care among repairers but also care *for material artifacts* by users and repairers. Jackson et al. study collaboration in repair communities, highlighting the tension between sharing repair expertise versus keeping it to oneself to ensure competitiveness [34]. Rosner and Ames argue that ability and desire to repair is situated in a community's values, expertise, socioeconomic constraints, and culture, relating back to how care depends on context [62]. Houston et al. explicitly connect values and care for material things, arguing that repair communities and the act of repairing are rooted in many different non-static values, such as what is worth repairing and what the end goal of repairing is [31]. Similarly, our study examines care in a collaborative setting, but in addition to looking at how humans care for technology or each other, we also explore how technology plays an active role in care and the underlying values that support it.

2.2.2 Learning Environments. Studies of care in schools seek to understand care in educational collaborations. Noddings contributed foundational work in this space, asserting that teachers should model and encourage caring behaviors in students [52], nurture multiple types of intelligence, and be sensitive to students' diverse backgrounds to instill a sense of caring in them [53]. This argument for care has given rise to studies that observe caring behavior in well-resourced [2], underserved [1, 9, 17, 27, 60, 65, 66], and online [20] educational settings, primarily in the United States. Some widely corroborated findings are that students are motivated by caring teachers [1, 2, 17, 42, 47] and that students perceive care when teachers take a personal interest in students and their backgrounds [2, 17, 27, 54]. Some of this work takes a cultural and critical race perspective, looking at how

African-American [27, 59] and Puerto Rican girl [60] students in the US and their teachers perceive care. Further confirming the importance of understanding students' backgrounds, Cassidy and Bates look at students at risk of dropping out of school and describe how school policies based on care create a flexible environment that adapts to a wide range of behaviors and history of lack of care [9]. Other studies also stress the importance of school policies and climate, such as how long a teacher spends with one cohort or whether care spills over into leniency, in the effectiveness of caring relationships [9, 21, 47].

A much smaller body of work examines care in schools in low-income countries. A study of students affected in direct and indirect ways by HIV in western Kenya showed that students' caring for their HIV-affected family members or not receiving care from them resulted in anxiety, highlighting the importance of family life in a student's education [65]. A similar study of vulnerable students in rural Kenyan schools showed how teachers, though they *"cared about"* students, felt they did not have the resources to actually give care and respond to student needs [66]. This study argues that care should not be devalued as a *"free resource"* but rather integrated into schools [66].

Building on this prior work, we examine care as a resource to determine how it manifests under the conditions at Vikas and contributes to the learning environment. We conduct this analysis with the recognition that the "learning environment" extends past the rules and regulations of the school to include students' parents, homes lives, and the individual motivations of each stakeholder. We then explore how technology design can draw on existing caring behaviors to strengthen learning environments, particularly in ways that may not directly target or impact learning outcomes.

2.3 Connecting Care, Design, and Learning

Among work that relates care and design, Houston and Jackson explore how design can support diverse repair situations, suggesting that designers and makers reduce artificial limits and legitimize repair to increase opportunities for care [30]. Saludo uses the theory of care to argue that sustainable objects should be designed to prompt user attachment, engagement and reflectiveness, sharing, and scalability [63]. We explore design recommendations for technology that interacts with care, also taking into account how *values* drive manifestation of care (as in Heuts and Mol's study of tomatoes [29]) and *agency* (both human and technological [40]) enables it.

Meanwhile, discussions around the design of learning environments have precedent in CSCW, but do not take a care perspective. Ames and Burrell study the environment of a Minecraft camp and how the game and the structure of the camp present equity challenges in learning [4]. Moed et al. study how dominance behavior in multiple-mouse learning activities can be reduced by the design of a more equitable learning environment [49]. This work considers how group dynamics and technology affect the process of learning, but inspires questions of how technology could support care to overcome conflicts and inequities that arise in collaboration.

Finally, HCI research on the design of educational technology, though focused on designing for context, misses an opportunity to view care as a resource to be leveraged. Kam et al.'s study in 2009 was the first to explore the potential of mobile phones for English learning for students in rural settings [36, 37]. Several exploratory studies on group learning were conducted around the same time to investigate shared technology access of then expensive classroom resources (*e.g.,* [3, 28, 56]). Recent works such as Cross et al.'s low-cost audience polling system [13] and Chetlur et al.'s flash drive–based learning platform [11] have provided greater perspective on the challenges we must contend with when we design educational technology for underserved contexts. Pal et al. stress the importance of not force-fitting traditional ideas of educational technology, such as a single ownership model, into different contexts of use [55] and prior work has argued that mere access to technology does not equate to students educating themselves, especially when they lack social

support [5, 24, 51, 71, 72]. Our work ties this literature to work on care and learning environments in order to highlight the opportunity to look for assets in underserved educational settings.

3 METHODOLOGY

3.1 The Learning Context

We conducted our research at Vikas[1]—an after-school learning center in Powai, a suburb near Mumbai, Maharashtra densely inhabited by migrants from various Indian states. Vikas was founded ten years ago by Dr. Usha, who ran a clinic in the neighborhood and felt motivated to provide free basic education to students from disadvantaged backgrounds. There are five government-run schools in the 500 meter radius around Vikas. Students from these schools (and others outside the 500 meter radius) attend Vikas either in the morning shift from 9:30 AM to 12:30 PM or in the afternoon shift from 2:30 PM to 5:30 PM, depending on when their school is in session. The language of instruction is Hindi for two of the government schools, Marathi (also the local language) for two more schools, and English for the fifth. As a result, students at Vikas are generally only fluent in one of three different languages of instruction, which can be a challenge for the teachers. While the government schools strictly adhere to the Maharashtra State Board curriculum, the teachers at Vikas review the topics being taught in these schools, teach new topics and skills, and also introduce extracurricular subjects such as arts, crafts, and music. Students at Vikas are also given computer training once a week.

Vikas had eight administrative staff (S1-S8), 12 teachers (T1-T12), six volunteers, and 75 students (in grades four through 12). Of 75 students, we interviewed 29. Dr. Usha, the coordinator, was in charge of securing funding for Vikas and overseeing it. Her staff consisted of six former students who, after graduation, had begun to work at Vikas part-time. At any given time, there was at least one staff member around. Some staff members attended college, while others held a second part-time job. These individuals were responsible for all administrative work, such as organizing paperwork for admissions, keeping track of finances, and keeping the center clean and in order. Teachers were full-time employees who taught and managed entire classes. They were paid hourly based on their qualifications (ranging from a high school diploma to a Bachelor of Education) and teaching experience (ranging from one to 10 years). Volunteers were students from a nearby college who provided one-on-one tutoring to students needing academic support. The center's facilities included four classrooms, one lab with five desktop computers and one printer, and five tablets, all connected by a Wi-Fi network. Two classrooms each had a wall-mounted television and a desktop that used the television for projection.

3.2 Field Research

With institutional review board (IRB) approval, we conducted fieldwork over nine weeks from December 2015 to July 2016. This included 120 hours of participant observations over 22 visits, 58 semi-structured interviews (six staff, 12 teachers, six volunteers, 29 students, five parents), one co-design workshop with teachers, one focus group with parents, and numerous "icebreaking" activities with students, teachers, and staff. In total, we observed more than 80 class sessions. The goals of this fieldwork were to gain a deep, situated understanding of the center's teaching and learning activities as well as to establish trust and rapport with all stakeholders.

We conducted our co-design workshop with five teachers, aiming to better understand *(a)* existing and aspirational uses of technology for their teaching and *(b)* attributes of educational technology that they would likely derive value from. All teachers at the workshop were women and between 30 and 50 years old. In this workshop, we collectively brainstormed the design of a content curation

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[1]All names have been anonymized.

tool (described below as Cur8) and asked teachers to consider use cases for such a tool. Our focus group consisted of 14 parents (12 mothers and two fathers) between the ages of 25 and 45 years. The goal of this focus group was to attain a broad contextual understanding of the students' personal circumstances and their parents' perceptions of the learning offered at Vikas.

We also conducted several team-based activities with students from grades six to nine to get to know them better. These included a yearbook-making activity, two Do-It-Yourself (DIY) projects involving web tutorials and recycled materials, the *"Lost on a Deserted Island"* activity [19], and the *"Fear in a Hat"* activity [18]. We also conducted the *"Lost on a Deserted Island"* activity with teachers and staff.

3.3 Cur8: A Mobile Probe

We designed Cur8—a mobile tool that we used to actively probe our teachers' comfort and willingness around using unfamiliar tools in the classroom. Drawing on extensive dialogs with Dr. Usha and design discussions with the teachers, we compiled a repository of relevant and appropriate digital learning content, in alignment with the curricula used at Vikas. This was mainly motivated by the teachers' and Dr. Usha's desire to make more content available to students, particularly those who ended up missing class. Cur8 is an Android application that allows teachers to search, favorite, share, add to, and build a lesson plan from this repository. Each lesson plan can include an array of materials, including PDFs, videos, images, and more. The contents of each plan are shareable using Bluetooth technology and WhatsApp (both widely used). All content could be consumed using applications available on teachers' phones and the devices available at Vikas. We observed the teachers interact with Cur8's features to gain insights into how they engaged with and organized digital learning content. Screenshots of Cur8 are in Fig. 1.

3.4 Data Analysis

In order to contextualize our data analysis, we first disclose aspects of the authors' identities that inherently affect our work. All field work was conducted by Aditya, who is a native Hindi speaker and communicated in both Hindi and English with the research participants. He was also able to blend in relatively easily because the volunteers who teach at Vikas were somewhat similar in age and ethnicity. Data analysis was led by Naveena and conducted in conjunction with the rest of the authors, who are all of Indian origin as well. We comprise two women and three men. All authors have pursued higher education in the United States in STEM fields, and have experience with research in India in the domains of education, mobile phone use, health, and gender, with experience in qualitative research, design, and system-building.

The data we collected was in the form of photographs, audio recordings, field notes, and interview transcripts, which we analyzed inductively as recommended by Merriam [46]. The authors coded the data line by line, captioning lines with phrases that summarized the content, such as *"maintenance of the center"* or *"quality of schooling"*. Over the course of several meetings, we distilled the codes into key themes. We eventually placed the data into high-level categories such as *"care enacted by members towards center"* and *"current use of technology for learning"*, which determined the headings of our Findings subsections. These themes highlighted the role of care in the center's workings and members' relationships. After bolstering our understanding of care as outlined in the Related Work section, we engaged again with our data to draw out the ways in which care was enacted and "exchanged" by all actors present—the students, parents, teachers, staff, Dr. Usha, and also the classroom technology.

4 FINDINGS

Through our field research, we uncovered how actors at Vikas transmit care for the creation and sustenance of a stable, safe, and healthy learning environment. We detail the ecology of Vikas below,
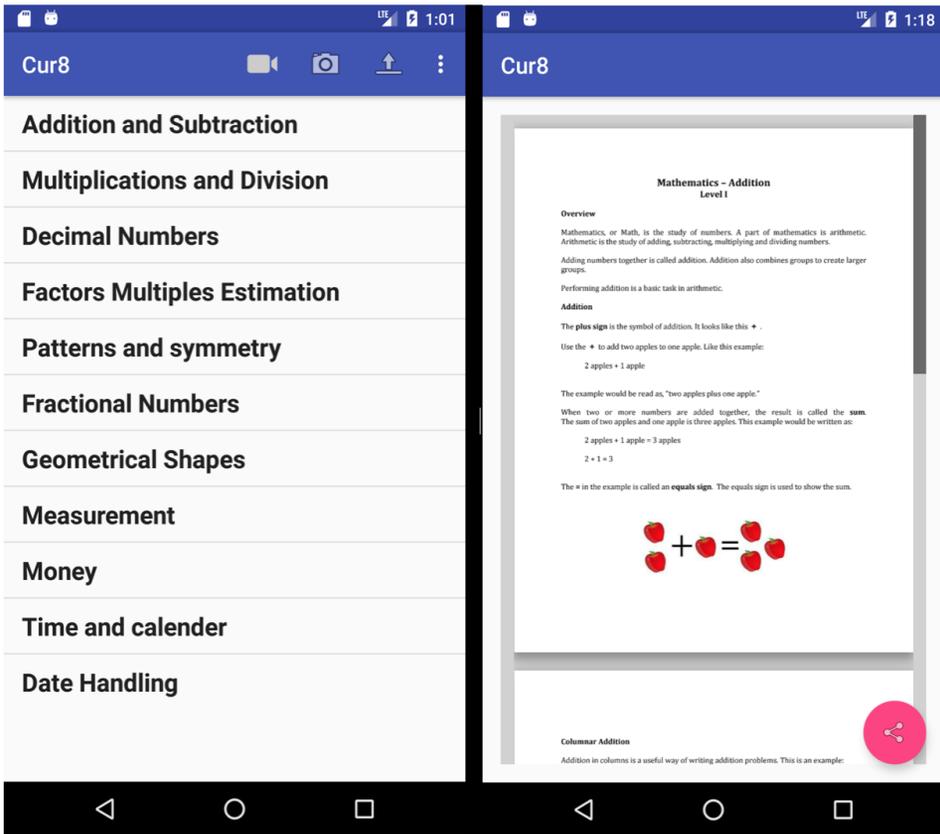
Fig. 1. Screenshots of Cur8. The first screen shows a list of subjects and the second shows a PDF document rendered in the app.

focusing on various aspects of the learning environment, as opposed to learning itself [14, 61]. We begin with a description of the values that color Vikas' operation. Throughout, we highlight the potential of technology in supporting care at Vikas.

4.1 "Giving each student personal attention and care"

4.1.1 The Genesis and Mission of Vikas. Dr. Usha, the coordinator, founded the center with a personal financial investment. She had set up Vikas such that no student was charged tuition to attend; Vikas only accepted a one-time optional enrollment fee of INR 500 rupees (USD 8). Dr. Usha also extended financial support by helping students find daily transportation to and from the center or by covering the college tuition fees of two of her student employees for their first year of college, for instance. She often took students to the doctor after class if they were feeling sick and treated many of them at her personal clinic for no charge. Through these acts of giving, she told us, her aim was to foster a unique culture of *"giving each student personal attention and care,"* an important aspect of care in schools according to Noddings [53]. When asked about Vikas' mission, she said:

> *"Vikas has many 'missions' . . . but I would say the most important thing is to help as many underprivileged students as we can, in whatever way possible. We do not want to have one*

formal structure of helping them—rather, we are very keen on taking each student on a case-by-case basis and providing to that student what is best for her or him."

In addition to providing personalized education, Dr. Usha felt strongly that Vikas should provide a home to the students so they feel as though they are part of a big family. This also comes with the freedom to make Vikas their own:

"I tell the children all the time that this is a family, all of us are a part of it. I do not manage them. I tell them to manage themselves . . . I am only a facilitator, not a principal or anything. The senior children do not ever bully or take advantage of their juniors. We do not tolerate any such behavior here. Everyone is made to feel responsible for the place."

Not only are students motivated by this care (as also found in [1, 2, 17, 42, 47]), the sense of belonging students feel at Vikas is palpable; we touch upon it in later sections.

4.1.2 Teachers' and Staff's Perspectives. The teachers and staff are paid nominal amounts (roughly ranging from USD 100 to USD 500, based on their expertise) per month. This is a small monetary incentive for their qualification and the efforts they invest in Vikas. All teachers stated that much of their motivation to teach at the center came from the values promoted by Dr. Usha and preserved by members of Vikas, pointing to the importance of the way learning environments are operated [9]. These values were then directed as care towards the students, as T2 shared:

"I'm here only for the students. I like coming here—I do it entirely for the love I receive everyday. You know, during the weekends, I miss these children a lot!"

Teachers' desire to give to the students went beyond teaching in the classroom, extending towards the creation of a *"stable and safe environment" (T5)* at the center for the students, many of who experience varying levels of physical and emotional abuse at their homes and in school. T2 expressed her desire to enhance the general style of teaching at the center so as to sensitize students and other teachers to the heavy baggage that many students carry. Given her degree in psychology, she wished to present her colleagues with a scientific argument for approaching the students with a more thoughtful attitude, saying *"I want to hold a teacher counseling workshop just for this."* Care, in this scenario, was directed towards the students, but expressed via a desire to work with and train other teachers.

4.1.3 Cultivating Social Values. Members of Vikas are quite conscious towards gender bias, perhaps since there is an evident gender imbalance in the student population. Dr. Usha explained:

"There are more girls than boys at Vikas, because Vikas is a free tuition service. Boys are sent to private and paid tuitions that may be better and have more experienced teachers, but so many girls are sent here because parents do not want to pay for their after-school learning."

This inequity came up repeatedly and Dr. Usha and other teachers and staff worked hard to create a safe physical space, instill progressive values with regards to gender, and inculcate a sense of ownership towards Vikas among the students despite their differences. They devoted extra time, leveraged their educational backgrounds however possible, and coordinated efforts for a consistent atmosphere. We also learned from Dr. Usha that this is not always the case, however:

"There used to be a lot of politics that happened with the teachers and students before. Very recently actually. I cleaned all that up. Once there was a Hindi versus Marathi groupism that started and teachers got involved in it too. We ensured that all that did not get out of hand. Even with love affairs—there was a teacher and a senior student who started to get very close to each other here. We told them to do this outside the center—Vikas is not a

place for all that. We're always trying to create a good and healthy atmosphere to learn and have fun only."

It is clear that Dr. Usha's mission—and subsequently the teachers' and staff's—for Vikas entails caring behaviors that ensure safety, equity, and a sense of family. Care may sometimes be misplaced, resulting in inequities or distractions from learning [21], as in the case above. However, as the situation demands, both firm and gentle actions are duly taken to preserve the values underlying the genesis of Vikas.

4.2 "Fixing" Problematic Norms

4.2.1 Intruding Societal Values. As members at Vikas work towards caring consistently for students, they are repeatedly faced with the challenge of keeping out conflicting values. As T2 said:

"We need to realize that most of these children come from very, very disturbed backgrounds and homes. The teacher is beating up the child in school, seniors or elder siblings bully the kids—these are very common. And then you have issues with the father and mother. On top of all this, some children suffer from a learning disability."

T2 mentioned that there was a need to recognize the capacity and lifestyle of each student, which can greatly affect their experience at school [65]. Many students, particularly girls, come from homes where they experience abuse. T4 said that she tried hard to address gender stereotypes and promote equity among her students:

"We want to give our children a sense of freedom; some parents are very against that kind of thing, and they take away their children. [. . .] There is also a lot of 'male ego' that exists with all fathers, and some of the male students too. They think that they are superior to women, and have the right to be loud, brash, sloppy. [. . .] I try to break that bias, and make the boys (and girls too) more welcoming of the other sex in the room."

Dr. Usha emphasized that the parents did not always like this and many were unwilling to send their daughters to Vikas because they were given *"too much freedom"* to interact with the opposite gender, attesting to the parents' differing definition of care [15]. Given the norms that are prevalent where the students come from, it is not surprising that gender bias is a recurrent concern. Teachers and staff recognized the importance of raising this issue with parents in addition to students, for otherwise students would likely revert to deep-seated beliefs on leaving Vikas.

4.2.2 "It's not the parent's job!" Many of the parents we interviewed, who did send their children to Vikas, had limited involvement in their children's education. Parents ensured that their child was being educated, but the lack of further engagement in their child's progress could well stem from the parents' own lack of education or depletion of time and energy spent on other aspects of livelihood. As one parent commented:

"I don't have time to focus on what my son does in school. I expect the school will do what it is supposed to do; why am I expected to intervene and supervise how my child is progressing? It's not the parent's job! Isn't that the teacher's job?"

This attitude affected students' study habits as well. Both teachers and students said that students whose parents were disinterested in academics struggled more to find an atmosphere conducive to studying at home, compared to students whose parents were relatively more supportive of their educational progress. The former category of students ended up studying for long periods of time at the center instead, to avoid being forced to complete chores at home.

In addition to being uninvolved in their children's education, parents were often ill-equipped to care for other aspects of students' lives, such as mental health issues. T9 shared:

> *"Look at one of my students. His mom works at home, his dad drives a rickshaw, and he
> has two elder sisters ... the parents do not care at all about the mental make-up of their
> child. Where is the time? And do you know why they don't care? It's because one's mental
> health is not something as tangible as other things ... And if they are told to have their
> child sent to a doctor for a test like this, the dad says 'No way, my son is not mad.' "*

Students also said that they felt unable to share their concerns with their parents. When discussing a problem that an eighth grader experienced in her school, she expressed great reluctance around communicating it to her parents:

> *"We do not tell or show our parents any of this, oh my god no way! It just does not feel
> nice to show and tell them such things. Anyway, first let them ask us how school was and
> what happened in school—only then will we maybe start telling them things. "*

Teachers and staff took multiple measures to secure greater buy-in from parents. Teachers regularly invited parents to the center for workshops. Additionally, teachers and staff explored WhatsApp as a method of regularly communicating announcements and updates to parents and each other. S1 said *"WhatsApp is great! We can immediately see who has and hasn't read the announcement, and we can then contact those people who did not see the announcement accordingly."* Here, Whatsapp enacted care by signaling acknowledgement of updates from parents (via read receipts). This information could then be translated into more proactive, personalized communication with parents. S2 had noted that most parents used smartphones and wanted to make a mobile app that could be used to send them announcements and updates. She tried to use the MIT App Inventor [48] to make an Android app, Googling her questions or checking the forums on the MIT App Inventor website whenever she hit a roadblock in development.

In summary, technology use in these scenarios attempted to provide the main bridge to involvement from parents, a theme that has been widely studied [74–76]. In this community, parents have specific resource constraints and expect a certain division of responsibility between schools and parents that makes it difficult to start getting involved. This presents an opportunity to explore further how technology can be designed to make care in the form of communication better targeted towards these parents' values.

4.2.3 Making up for Quality of Schooling. In addition to contending with misaligned societal and parental values, teachers and staff at Vikas also recognized that the quality of education at the students' regular schools left much to be desired. T7 expressed her indignation:

> *"You know, if you ask any of them to tell you the spelling of any word, they'll be able
> to immediately say it. But they won't know the meaning. This happens many times too.
> Schools teach them to write, pronounce, and spell a word, and there is rarely a focus on
> understanding the meaning of the word. It is almost impossible for us to unwind this rote
> learning here!"*

In addition to problems with teaching styles, students also shared that they were treated poorly by the teachers at school. A girl in eighth grade mentioned:

> *"There is this one male teacher in school who we're all scared of. He runs behind us
> sometimes to hit us or punish us! We hate him so much. He beats girls too a lot when they
> talk or run and play, or do not come back to class on time after the break."*

These descriptions point to the deep divide separating school and home life and the problematic norms that students have become used to navigating at school. T7's complaint about rote learning at schools attests to the amount of work teachers at Vikas must do to make up for the lack of a holistic education, which warrants a section in itself.

4.3 "Vikas is like our second home."

4.3.1 Maintaining Vikas. Students and staff demonstrated attachment and desire to give back to Vikas, a testament to Dr. Usha's focus on instilling a sense of ownership. Many staff members had been students at Vikas previously and were now employed by Dr. Usha to manage logistics of the center. One such ex-student S5 was pursuing his bachelor's degree in interior design at a government college. One month prior to the start of our study, S5 used his skills to design and install the center's courtyard flooring and tiling all by himself for a college project. In one of our conversations, he described why he continued to spend time and work at Vikas:

"Vikas is like our second home. See the group of children relaxing and chatting here now [pointing to students sitting in the courtyard]. We come here whenever we have nothing to do and we just sit here and chat about everything from college, to school, to general gossip, to anything. We cook food here too—there are utensils here as well—or we sometimes order food. So many people come here to just relax and spend time with friends. Many don't want to go home, because once they are home, they're stuck there for the rest of the day, and the situation for many of them isn't too great at home either."

The primary motivation for this maintenance work was to create a welcoming environment for students who came from challenged home settings. This also translated to acts of repair as needed. For example, one morning (in the monsoons), we found that S1 had created an elevated cement platform so rainwater would not flow into the courtyard. This was so that the center could continue to hold classes there, rain or shine. This speaks to the willingness of S1 to put in the effort for Vikas and the sense of ownership that Vikas inspired in him.

4.3.2 Managing Vikas. Another pursuit that emerged was that of using technology to better manage Vikas' administration. S3 had taken the initiative to digitize all attendance and fee records of students from the past two years. He was drawn to computers:

"I love computers! It makes work so easy! I've digitized all the teacher and student records here, and everything is now backed up in a Google Drive. Sometimes teachers tell me I'm wasting my time, but now if Meera Ma'am asks me for Swati's phone number, a simple Control plus F can help me find it easily . . . Furthermore, it is my personal goal to digitize all of Vikas' data . . . When I visited this other school some time back, I saw that each student had their personal login ID and password and they could see their weekly progress and marks and graphs. There were also personal comments from teachers. I want to do something like that."

S3's aspiration towards creating individual profiles points to how technology-mediated care can manifest in personalization of content and communication. However, S3's experience shows it may take time to recognize actions as care in the first place due to context [50] and explicitness [38], especially work done through technology. For example, S3 shared that his effort to digitize records was received with skepticism at first and many teachers told him he was wasting time and could instead be helping with other errands, *"like cleaning or organizing desks in the classrooms, instead of sitting in front of a computer screen typing all day."*

4.3.3 Presenting Vikas. A sense of ownership also made some members keen on using technology to improve the center's public image. T9 mentioned:

"I was also thinking of making a new website for Vikas, because the current website was made by a person who then left and now we don't know the password. It's a silly reason but it is a big problem."

This example points to the extra work that may be required because, while technology is desirable and attractive, it takes expertise and consistent attention to create and maintain. This may not always be easy to ensure even when care is present.

This care involved in maintaining, managing, and presenting Vikas mirrors and extends the findings of Rosner and Ames [62] and Houston et al. [31] regarding the efforts required (and made) to maintain and repair things of value in appropriate ways. The value is inherent from S5's account of how students collectively draw meaning from their time spent at Vikas. This value then drives the staff to make day-to-day operations easier and to present Vikas in a positive light by way of technologies.

4.4 Targeting an All-Round Education

Teachers focused on cultivating skills that would prepare students to take on the world once they left Vikas. We highlight here the importance that teachers gave to internet skills, English communication skills, and learning co-curricular subjects such as art and computers, all of which go beyond what students learn at school. We also note the heavy reliance on technology below for this all-round education.

4.4.1 "General Life" Skills. One of the teachers T9 shared that she made sure all her students learned to use email and made an email ID for them all. Her view was that email was important for *"general life"*, not just for school. When asked whether students ever accessed their email outside Vikas, T9 remarked:

> *"I don't think so. They will not do all that maybe. But still …I take it upon myself to teach as many children to use email as I can. I know from my experience applying to colleges and jobs and other things how valuable it has been to have an email."*

In addition to email, Dr. Usha stressed the importance of giving the students freedom to use the internet:

> *"My students should take the initiative to pursue their interests. I give them the freedom to use the Wi-Fi, and explore the internet whenever they want. Yes, we maintain some level of discipline with regards to what they browse, but we still give them that opportunity to explore. On Saturdays, they watch videos on the TV—and we know our senior students will ensure that the videos they watch are appropriate."*

Newly enrolled students were often guided by older students and staff members to familiarize themselves with using the tablets and desktops. This was helpful since most new students had not previously worked with a tablet or desktop computer and did not have these devices at home. It was at Vikas, then, that they found the freedom and ability to pursue tech projects of interest to them. We observed during our study that the students started searching YouTube for DIY and "how-to" tutorials on topics such as movie animation and graphics (*e.g., "How was this movie made?", "How did they create those stunning effects?"*), cooking recipes, and the making of toys, projectors, Virtual Reality viewers, 3D hologram generators, and bells from cardboard and recycled waste. We also note, however, that although everyone was keen for the students to engage with the technologies thus, they still had some reservations. Dr. Usha confessed:

> *"I am scared to allow students to use my personal device for any learning-related apps. Initially, I was scared to even let them use the tablets because I had used my personal email ID to sign in to the Play Store. I had my personal Gmail on the tablets by default and I also had WhatsApp and other messages on my phone. It is also useless to have a pattern or code lock for such devices because the students need to know the password to use the apps but at the same time, all the other apps are not locked! I recently learned that you have these specific app locks that are great and I use them now in my personal phone."*

4.4.2 English Skills. Using the technologies present at Vikas also meant, however, that a working knowledge of English was needed. This language constraint comes up frequently in ICTD research (*e.g.*, [39]). Many members at Vikas recognized the value of learning to communicate in English. This was mentioned by students too. As a (male) eighth-grader said:

> *"We want to learn English very badly. Whenever I get a job in the future, everything is in English there—we have to talk, communicate, write, use laptop in English only. There is no Marathi there, but we study everything in Marathi in our school. When we go to work, we will only suffer with not learning English. "*

The focus on learning English is exemplified by some teaching tactics. T2 mentioned that she preferred Googling in class because it improved the English skills of her students. She explained, *"They learn to restrict their thoughts to short search phrases or keywords and this helps even the non–English speaking students learn English faster."* Though prior research has examined English learning in ICTD settings (e.g., [36]), we postulate that an assets-based approach might bring greater success.

4.4.3 Co-curricular Skills. Teachers also held *"compulsory art and computer classes" (T8)* and did not teach core subjects on Saturdays so that students could receive a well-rounded education. We observed one of the computer classes in session and share an excerpt from our field notes:

> *"The 8th graders got to spend some time on the computers learning Logo. They were taught to use the 4 basic commands (forward, back, left, and right) and were guided to make a simple square. Very soon, they were making houses and other things . . . Two people were sharing one PC and they would take turns. "*

Although teachers did stress the importance of art and dance in addition to computers, most adults and students were particularly drawn to engaging with computers and tablets. As T12 said:

> *"If the kids have a computer class coming up, they will get impatient for it, and they'll put pressure on the teacher to end this class fast—and their attention is elsewhere for the entire class. So sometimes, the PC is so exciting that it makes them lose interest in the classroom with the teacher. "*

In sum, Dr. Usha, teachers, and staff all cared for the students to grow in well-rounded ways, but we also saw that this care did not come without its need for boundaries. There was awareness that the technology could distract students or enable them to do many different things that were not learning-oriented. Uncovering these issues with the use of technology in the classroom extends the work done by Ames and Burrell [4] and Moed et al. [49] to describe how a care-based learning environment is uniquely affected by the affordances of a technology, in this case impacting the devices and phones students have access to.

Notably, the desire for an all-round education touches upon the basis of connected learning, which emphasizes the importance of learning that is socially embedded and interest-driven [33]. There is room for this to be explored further, particularly in underserved ICTD contexts, where traditional education is given paramount importance.

4.5 "All the actual learning happens only here!"

Driven by a strong desire to be different from the schools, teachers at Vikas enthusiastically explored new approaches for improving the quality of teaching and learning at the center.

4.5.1 More Technology! Our participants, and Dr. Usha in particular, voiced strong opinions around the value that technology could provide (or not) to the students at Vikas. Many of these conversations emanated from a lively discussion of Cur8's offerings, which was a mobile app we had designed and prototyped in response to the teachers' inputs in the first place.

In general, and regardless of their own tech savviness, teachers and staff were optimistic about what technology could accomplish in their classroom. They were heavily in favor of leveraging the technologies available to them to access new ones. T5, for example, was keen on using virtual reality (VR) technology to make learning more engaging and effectively demonstrate the rotation and revolution of planets in the solar system. S3 also said that he had looked into the different VR technologies in the market and was particularly interested in using Google Cardboard [8] since it was low-cost and easily procured. Two students added that they had been fascinated by VR based on Samsung and HTC advertisements they had seen.

Care, in this case, may be seen in terms of willingness to engage with new technologies and learn new skills to create a better learning environment. There were apparent downsides to using technology also, however, because its functions could be used for other purposes, undermining the role of care in the teacher-student collaboration. As S4 explained:

> *"Since we have computers and tablets here, sometimes kids get carried away and get addicted to playing games or they generally get distracted. [. . .] The simple fact that they can easily access an answer to a question via a google search itself makes them feel like they do not have to worry at all about any question they may have. They are sometimes overly confident that they can easily get an answer to something, and in my opinion, it sometimes makes them lazy. They can even start studying less. And sometimes, they start respecting the teacher in the class less. They pay less attention and the novelty of having a teacher can get destroyed. Especially with the teachers who are slightly soft-spoken."*

4.5.2 More Content! There was no question that more (and free!) content was needed and desired—for teaching and for learning. Teachers voiced the desire to access high quality content online and share it with each other (through Bluetooth and WhatsApp) so that the quality of teaching at Vikas remained high. They also wanted PDFs of books to be available to students on tablets (again, for free). Many believed in the power of the internet and the content that it housed. T2 argued, for example, that repeated Google searches exposed her to new research and tangential fields of study and she believed that she would learn more through directly searching for internet resources versus accessing learning content from an app (such as Cur8). She also approached teaching in this way and enjoyed having students Google and learn on their own. This also broke the monotony of classes, she felt.

A major roadblock that repeatedly arose was language again. T11 mentioned using MIT Open-courseware to find relevant videos for lessons, but English posed a challenge:

> *"It is all in English and I am able to comfortably convert it to Hindi/Marathi while teaching. But I feel like the other teachers miss out so much since they cannot access this kind of wonderful English content. So many teachers rely on just the textbooks for class preparation."*

Care manifested here in the efforts teachers made to find content so they could learn more themselves and improve their teaching. It is important to note, however, that care in the form of free, shared content intended to enrich anyone's learning experience falls short when the technology's agency does not align with the user's. The videos being in English presented a barrier that teachers without English skills found challenging to circumvent.

4.5.3 More Context! The issue of language spurred discussion on the topic of locally relevant user-generated content. This was seen as potentially benefiting students who were absent, which was often the case. One teacher T6 shared, *"I want to launch a YouTube channel to share videos of my lectures and organize all the videos I use into playlists for ease of access."* She added that she saw the

internet as a sharing platform that could allow her to reach like-minded teachers who also wished to improve their use of contextualized learning materials.

Not everyone found it pedagogically attractive to show videos to students, however. T2 remarked, *"There is nothing they learn from that. You know why? Because videos are passive. The child is doing no thinking or active work on their own—they are just watching someone else do the talking. And there is a disconnect because that someone is behind a screen."*

Teachers were also concerned about the collaborative context of the classroom. Sharing devices during class was common but not desirable. T11 asserted that sharing tablets imposed limitations on students and made it difficult to check if all groups were paying attention as she intended for them to. Students were distracted because the affordances of these tablets were many. This is also why teachers like T8 felt that an app like Cur8 would keep the students focused and learning:

> *"I want to load this app you talked about on all our Vikas tablets. Don't want to search for a readymade app on Play Store because that app you download cannot be customize[d]. Here, we can decide what kind of content we want to have in the app and no extras, like the other external[ly] downloaded apps we have right now."*

Teachers were keen to brainstorm how students could create contextualized content as an educational exercise. S3 and S4 pointed out that most students visited their family's home states during holidays. T3 and T7 suggested that, for the next holiday, students take pictures and write stories or short notes about their hometowns and neighborhoods (in Mumbai and their home states) in order to create a map of students' homes to share with friends and family. T6 said that hosting this content on an online platform would facilitate sharing this learning experience with others.

This proclivity for use of online tools would not be so easy without Dr. Usha funding internet access and encouraging teachers and students to explore new approaches. Dr. Usha's enactment of care shapes the way the center acts as a home for members of Vikas where they can study, explore diverse interests, and even fill out college admission forms.

5 DISCUSSION

Our findings presented a range of caring behaviors displayed at Vikas. We now discuss the potential of care as a resource and how it contributes to a healthy, safe, and personalized (though perhaps insular) learning environment at Vikas. Next, we discuss how the alignment of values (or lack thereof) impacts the success of care. We then describe how technology might exercise agency in determining how and which values are enacted. This leads us to make design recommendations for technology to support, leverage, and extend care towards stronger, albeit underserved, learning contexts.

5.1 Care as a Resource

5.1.1 Establishing a Sense of Ownership. We mentioned the importance that Dr. Usha and teachers gave to a "personalized education" and truly incorporating students into a big family no matter their backgrounds, whether they faced abuse or dealt with mental health issues. Older members would invest in keeping Vikas clean and organized, helping younger students get accustomed to the daily routine. Teachers, staff, and students had freedom and willingness to engage with technology on their terms (as in the case of identifying online resources to teach better, digitizing students' records, or taking on DIY projects). All these factors led to a sense of pride and ownership at an individual level, accomplishing two goals. First, and more obviously, it helped make the center more sustainable, despite financial constraints, since the resources they had were used more appropriately. Second, ownership resulted in students and staff seeing projects through and learning to work around obstacles, leveraging the access that they had at Vikas.

The physical environment of the center being well taken care of in turn made it a caring space. Over time, students grew attached to the center and felt a sense of belonging, mimicking the cycle of care between teachers and students but with physical space. Keeping Vikas clean, functional, and conducting caring activities, like cooking or ordering food or meeting up to chat, turned it into a workspace, meeting point, and recreational center, "taking care of" the students as much as they took care of it.

5.1.2 Fostering an Interdependent Social Dynamic. Care fostered interdependency—a trusting and secure relationship among those at the center, *i.e.*, students, teachers, staff, and Dr. Usha. The desire to create a safe and stable environment for the students meant that older members would welcome new ones, help them get accustomed to it, teach them to use new technology, and walk them back home after hours. Spending more time at Vikas (since it was a work- and recreational space) also meant that students established deeper relationships with each other and the staff. The teachers' focus on a well-rounded education meant that students were learning similar values and life skills, increasing common outlooks and interests between students and teachers. Teachers were evidently united in their vision for the students, motivated to guarantee them an improved quality of life. In addition, the use of technology such as WhatsApp groups for sharing resources across the center kept them connected and in communication. The fact that some students returned to contribute their skills to the center points to how receiving care produced students who wanted to give care as well. The way teachers and staff considered working at Vikas "giving back" to the community also attests to the power of care to elicit care in others. In these ways, the relationship among actors at Vikas shows the benefits of care that is *"ongoing"* [29]—the interdependency fosters closeness that creates opportunity for new and future interactions.

5.1.3 Building Bridges Between Communities. Our findings highlighted that while Dr. Usha and the teachers made concerted and regular attempts at connecting with parents of the students to keep them informed and updated (through WhatsApp groups, for instance), this was a challenge, as has been found in multiple other contexts [74–76]. Parents had their own grueling work lives and were sometimes ill-equipped to address the problems of their children. Meanwhile, in Vikas' efforts to do more and better than the students' schools, there was a clear gap between the two learning environments that students attended in terms of subjects taught as well as attention and care given to students. In fostering greater respect for the opposite gender, for example, Vikas became even more disconnected from the external environment that students were part of. Despite the fact that Vikas successfully provides a safe and stable space for its members and inspires a sense of pride and ownership in them, it may also unwittingly generate touches of misguided pride or unhealthy attachment that manifest as insular tendencies. There may be more work to be done by Vikas in terms of staying in touch with the outside world. Like with any other resource, wise and appropriate allocation of care can ensure that it reaps greater dividends.

5.2 Aligning Values with Care

We now discuss the role that values play in driving the caring interactions we described, noting that care both works towards aligning values and works when values are aligned. In an example of the former, Dr. Usha decided what makes a *"good"* learning environment (as phrased by Heuts and Mol [29])—providing a safe and healthy space with personalized attention to each student. In her efforts to *make* the learning environment *"good"* [29], or in other words asking *"how to care"* [15], she hired teachers and staff who subscribed to these values, agreeing to devote their time, take interest in students' lives, and invest effort into teaching well. Teachers then cultivated the same values in students—non-violence, respectful and helpful interactions with all students, initiative, and responsibility. This transfer was evidenced by the fact that students knew what they did not

value, given their distaste for the abuse teachers inflicted in school or how parents never asked how school was going. Caring behaviors such as returning to work at Vikas or modeling respect and ownership to younger or newer students stemmed from the alignment of students' values with the teachers' and Dr. Usha's, to the extent that we can estimate values from the specific behaviors we observed at that period of time [35].

Even in technological interactions, alignment of values was essential to care. Showing care through technology required users on all ends to use the technology to affirm the same values. For example, creating WhatsApp groups was motivated by the desire to stay in communication with the parents of students at Vikas. Those who (seemingly) valued this communication of school-related content would read the messages, signaling that the staff members did not need to follow up with them or do *extra* caring work.

However, the *making* of a good thing is complex, and values will inevitably conflict [29]. As a result, caring involves an ongoing process of negotiation or tinkering between values both implicit and explicit [50]. While teachers tried to use technology with students so they could engage with educational content or learn to research topics, students' implicit values were not always aligned in this regard and would be diluted by desires for leisure or socializing. Caring efforts to foster a free environment were occasionally thwarted as was evident in Dr. Usha's concerns around use of her personal email account, for instance, which led to Vikas relying on workarounds such as app-specific locks or senior students monitoring junior ones to ensure that the technology was used for learning as intended. Values also appeared to be misaligned in the case of parents not recognizing the care teachers gave to the children, like encouraging talking to the opposite gender, as appropriate. Since parents raise their children with certain values (actively or passively cultivated), a misalignment would result in values taught at Vikas to not be reinforced in students' home lives. This would create more caring work for teachers in order to keep the values operational at the center aligned both within Vikas and with the larger community or "the real world".

5.3 Using Technology to Care

Having discussed so far that care is a resource but, for maximum benefit, values must also align, we now discuss the role that technology might play in *"tinkering with"* [50] or aligning these values to support, leverage, and extend care. We argue that the agency of technology (as viewable from an Actor-Network Theory perspective [40]) can play an important role in shaping the translation of values into action. We conceptualize caring behaviors as people having a set of values and a set of abilities. Values determine which set of actions would promote well-being [29] and care drives people to take those actions. The set of abilities a person has available to them can be supported and shaped by technology. For example, in the case of misuse of tablets in the classroom, teachers intend for tablets to be used for educational purposes and tablets allow for those purposes. However, the same features of the tablet might be molded to suit the differing values of students, or encourage students to enact a different value. Even when values are aligned, as in the case of teachers trying to access content via MIT Opencourseware, the agency of the technology might result in inequities (on account of English use), rendering the values embedded in the technology inaccessible.

Technology can also support the alignment of values, as in the case of the WhatsApp read receipts encouraging more targeted communication or app-specific locks preventing tampering by students. Technological affordances can mold the actions of the carer or person receiving the care such that actions align with the overall values of the system the actors exist within. This conceptualization then brings up the question of how technology design can achieve this in learning environments like Vikas so that the benefits of care are maximized. We offer recommendations below.

6 DESIGNING WITH CARE

We now discuss the role that technology might play to support, leverage, and extend the caring behaviors we studied. Once again, we take an assets-based approach [43], building on existing resources and familiar practices. In our recommendations, we focus on how technology might allow for aligning diverse stakeholders' actions to the values that drive Vikas' learning environment. We focus on shaping of *actions* in light of the recognition that it is difficult to assess what a person's values may be in their entirety and at every moment [35], while their actions are discernible events.

We examine how existing technological interactions might be *leveraged*. As our findings show, smartphones were prevalent across the board (even among parents in slum communities), and social computing technologies (such as WhatsApp) were widely adopted. Members at Vikas already used WhatsApp to communicate with parents and among themselves; this allowed for targeted communication and minimal tracking to ascertain who had received the communication. This practice could be further leveraged for communicating and aligning values (say, regarding gender equity) through gentle and careful selection of multimedia content that is found to be widely circulated across demographics in India (as new incarnations of email forwards) [45]. Further, although parents did not believe they had time to be involved in their children's progress at Vikas, teachers and staff could share quick and easy messages (such as photos or short videos, instead of detailed progress reports) to succinctly signal how things are going. In fact, video as a form of school-related information dissemination for parents has been found to be successful for low-literate families in the United States [7, 64]. Notably, WhatsApp has yet to receive features that support low-cost input from conversation groups, such as polling or event invitations. These features are available, sometimes as a plug-in, in analogous apps such as Messenger, Slack, GroupMe, and WeChat, and could potentially be tapped into (*extending* existing behavior) to go beyond giving parents information and actually get input from them on, say, a lesson plan, school event, or their child's progress. A better understanding of parental technology use in the student's community might also inspire methods of communication that are more in line with how parents consume media [12, 23, 41].

We also look at how practices could be *combined* to serve multiple objectives. Boundaries separating Vikas from the outside world could be blurred further, for example, by getting students to take photos or videos at home and use their parents' devices (that they are comfortable using) to send these in to teachers. Technological devices at Vikas could then be used to facilitate discussion and encourage students to share about their home settings; this could help students begin to mentally connect seemingly disconnected environments [32]. These exercises could gradually be extended to have students engage in more elaborate media production activities involving reflections towards potential civic engagement.

Within the center, collaboratively framing the contents of Vikas' website, as was undertaken by a staff member, might be one way to articulate the values of Vikas for each member's awareness. Sharing photos and media generated at Vikas on this website (or potentially a Facebook page) could be another way of maintaining a shared vision and values. Once again, social computing technologies could come to the rescue.

Other caring behaviors could also be combined and extended. For example, students and staff were keen to do small projects for maintaining Vikas and were also familiar with "YouTubing" DIY projects of various kinds. These practices could be conjoined so that students are actively engaged on a regular, ongoing basis through DIY projects for the center and engaging fruitfully with online communities towards well-defined goals. Engaging thus with the assistance of teachers and staff could allow students to explore their hobbies and interests online with greater focus; this could potentially move them towards careers of interest after graduation. Once again, considering the

way care could support interest-driven interactions, combining and extending care in the learning environment could open up options for implementing connected learning [33] in an ICTD context; this is an avenue for future work.

We saw that despite all the freedom Vikas gave to students, values became conflicted and concerns around trust arose when there was unrestrained use of the internet or of personal devices (such as Dr. Usha's). App-specific locks could be expanded to be time-specific based on class periods or theme-specific based on apps' main uses. With the introduction of screensharing options, students and teachers could be on the same page in the classroom and ensure that students remain focused when focus is needed. Just as Cross et al. [13] examined the use of QR codes in classrooms, there could be innovations that improve visibility and transparency focused on ensuring that technology use is a collective endeavor and not an individual undertaking.

Finally, almost all members of Vikas were keen to engage with more technologies for learning (such as VR) as long as they were low-cost. However, availing content that is understandable and contextually relevant remains a challenge. Future work is needed on devising easier and contextualized curation of content and the design of crowdsourced online content repositories with a more sympathetic view of those not fluent in English. Leveraging some teachers' and/or students' willingness to create and adapt content, content repositories could be designed such that different local language voiceovers or text for the same video or worksheet could be crowdsourced the way content itself is crowdsourced. This would appropriately build on recent work by Vashistha et al. that proposes a system that combines the strengths of crowdsourcing and automatic speech recognition [70].

7 LIMITATIONS

We address here the concern that Vikas may be quite different from other schools, bringing to question the generalizability of our findings. While generalizability is a common concern that arises with qualitative research [44], our extensive experience with underserved school settings across India allows us to assert that although care may manifest differently and to different extents, it is present in respectable measure across the board. Additionally, we highlight that our focus was not on learning outcomes in this study, given the wide range and richness of care observed, but our research could be built on to motivate greater attention to addressing how care drives improved learning. Finally, we suggest that our ethnographic findings may not be generalizable, but our approach is, *i.e.,* focusing on care (via an assets-based approach), understanding how values align to motivate care, and devising mechanisms for technology to support, leverage, and extend this care.

8 CONCLUSION

We conducted ethnographic research at an ICT-enhanced after-school learning center in Mumbai (India) that caters to children from neighboring slum communities. We conducted extensive data collection, primarily through participant observation and semi-structured interviews with different stakeholders (including teachers, staff, parents, and children) at the center over nine weeks from December 2015 to July 2016. Taking an assets-based approach in an underserved context, we uncovered the role of care as a resource and presented the rich and varied caring behaviors enacted in this sociotechnical system. We then discussed how care effected a greater sense of *ownership*, *interdependency*, and *community* at the center. Examining the role of aligning values in motivating caring behavior, we concluded with recommendations for supporting, leveraging, and extending care via technology design in an underserved, ICT-enhanced learning environment.

9 ACKNOWLEDGEMENTS

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