Kelsa+: Digital Literacy for Low-Income Office Workers

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***Abstract*—**Almost all formal organizations employ service staff for tasks such as housekeeping, security, maintenance, and transport at their office facility. Many of these workers earn wages in line with menial-labor salaries in their respective countries. They have few on-the-job opportunities to upgrade their skills or learn new ones. *Kelsa+* is an initiative through which organizations in developing countries can increase digital literacy and skill development among such low-income workers, through the provision of an Internet-connected PC for the service staff's free, unrestricted use when off duty.

We study a Kelsa+ pilot implementation in Bangalore, India, involving an office facility with 35 service staff. In a preliminary exploration over 18 months, we find that at a cost that is negligible for the organization, workers' use of the Kelsa+ PC is high and can deliver benefits both to themselves and to the office. For workers, broad gains were seen in confidence, self-esteem, and basic digital literacy, while a few individuals experienced improvements in second-language (English) proficiency and career opportunities. These early results point in the direction of a cost-effective ICT4D initiative that could be run in the developing-country offices of the very organizations promoting development off-site.

***Index Terms*—ICTD, digital literacy, service staff, low-income workers, urban poor**

I. Introduction

Those of us working in "information and communication technologies for development" (ICTD) often run projects in remote rural areas or urban slums to work with low-income communities. Meanwhile, we often neglect a low-income group right under our very noses: workers who clean our offices, provide security, maintain facilities, etc.

Most offices involve a sizeable group of service staff, who take care of the housekeeping, security, transport, maintenance and so forth of the facility. In developing countries, service staff tends to be employed in large numbers, with many of them earning wages equivalent to those for menial labor in the same geography. In India, for example, the ratio of support staff to direct employees can range from 10% to as high as 60% – 30 support staff for an employee base of 100 is not unusual. Given that the corporate IT and ITES sector alone employs more than 1.6 million professionals in urban India [1], the support staff at these facilities would involve a population of at least 160,000 and more likely 320,000 urban low-income workers. Such workers typically have limited or low-quality education and earn between $50 and $200 per month. They have few on-the-job opportunities to upgrade their skills or learn new ones, and therefore remain caught in a vicious cycle of low-income work.

We propose Kelsa+, a program that offers Internet-connected PCs for free, unrestricted use to the low-income workers in modern offices in developing countries. In our 18-month pilot, we tried several things to encourage usage and improve development impact, and recorded a variety of positive, if limited, results. Kelsa+ could thus be a worthwhile project to spread to other offices in developing countries, if these benefits could be delivered more systematically.

In this paper, we report on our pilot experiment with Kelsa+ in Bangalore, India. We discuss our design decisions, describe usage patterns, and identify explicit development-focused opportunities and outcomes. We also discuss some of the potential challenges to adoption by other organizations.

Although PCs are likely to have been made available to service staff elsewhere, perhaps on an informal basis, to our knowledge, a deliberate exploration of the design and value of such a project has never been conducted before.

II. Related work

There are three threads of research that are relevant to the Kelsa+ study: the Hole-in-the-Wall experiments for children, computer-aided learning for adults, and computer kiosk or telecentre initiatives aimed at promoting development in poor communities.

The 'Hole in the Wall' (HitW) experiments

The National Institute for Information Technology (NIIT) [2] ran a series of computer-based education experiments with children from disadvantaged communities in New Delhi, India, in the late 90s. Effectively, they bore a hole in the wall that separated NIIT from the neighboring slum settlement and had an Internet-connected PC set up facing the settlement, with a touchpad built into the wall for navigation. They found that

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children from the slum communities in the vicinity (mostly 6 to 14 years old) explored PC usage on their own using the device, resulting in significant learning benefits without any formal instruction. HitW interventions for children have been conducted at various rural and urban sites, and the pattern of improved digital literacy from this Minimally-Invasive Education (MIE) intervention has been consistently recorded [3].

Critiques of the project have come from those who see the "digital divide" not as "gaps to be overcome by providing equipment," but as "social-development challenges to be addressed through the effective integration of technology into communities, institutions, and societies" [4]. Such critics find the HitW intervention to be "technologically deterministic" and lacking in community and parental involvement. Further, they question whether simply having physical access to an IT device and learning a set of basic IT skills would translate into any systematic improvement in the lives of these children.

Kelsa+ was initially inspired by the 'Hole in the Wall' project. It examines unrestricted PC access not for children, but for adults, specifically low-income urban workers, though within an institutional and social context.

Computer-Aided Learning for Adults

Computer-Aided Learning (CAL) has existed in various forms for a number of decades as an educational tool in schools [5], universities [6], healthcare institutions, and is becoming an important area for ICTD investigation in developing country contexts [7]. Early experiments in basic computer-assisted instruction, comprehensive historical overviews of which have been done [8], has led to more sophisticated recent work around using robotics for science education [9], facilitated distance learning [10], and so on.

However, there have been relatively few investigations around uptake and impact in the context of CAL for adult learning. One study identifies the importance of CAL in maintaining the continuity of learning history of adults, arguing that such use of computers in learning will be able to shift the focus of cognitive energy to cognitive creativity, allowing adults more space for absorption of knowledge and creativity [11].

Kelsa+ examines a subset of questions in the domain of CAL for low-income urban workers in developing countries.

Computer kiosk and telecentre ICTD initiatives

Most of the adult digital inclusion projects in the developing world have been undertaken as computer telecentre initiatives [12]. These typically, though not always, involve a small number of PCs set up in a rural area, offering a variety of PC-related services and run by an entrepreneur, salaried operator, or a community-based organization. The expectation in these projects is often that once ICTs such as the PC are made physically available in communities where they did not exist before, there will be usage by members of the community and socio-economic development will follow. This approach is evident in the project concept notes and promotional material of several telecentre initiatives: "by providing information about employment, better farming techniques and health we hoped for new sustainable job opportunities, improved farming knowledge and healthier life." [13]

However, many of these projects have found it difficult to sustain the technology and to establish clear links between ICT access and development impact. In many instances, usage of the facility (and therefore revenues in for-profit kiosks) falls over time, irregular connectivity in remote areas causes periodic interruptions in service provision (and further decline in usage), device maintenance accrues unanticipated costs and where high usage persists, it is often for the usage of applications with limited welfare impact and by community members who are not particularly disadvantaged (making it hard to justify public expenditure) [14],[15]. Many programs face a tension between pursuing financial sustainability and maximizing social outreach [16]. Those kiosks that are able to sustain usage often involve an exceptional kiosk operator or a committed organization that is able to effectively coordinate between the end-users and the desired application [17].

In contrast, Kelsa+ operates in a modern office environment, where exactly the elements for sustainability are already present – IT maintenance and support, good physical, electrical, and connectivity infrastructure, caring staff, etc.

A few kiosk projects, such as the Akshaya project in Kerala, have explicitly pursued adult digital literacy as an objective [16], [18]. Despite the project's impressive scale, however, field studies suggest that these programs achieved neither the reach nor the depth of digital literacy that was sought [28]. We hypothesize that one reason for this was that digital literacy courses were conducted over very short time periods (10 sessions of 90 minutes each), which did not permit learners enough time to familiarize themselves with the technology.

In Kelsa+, interaction with the PC is voluntary and continuous in a process we call "digital habituation" [19]. This allows the incremental build-up of digital literacy skills at a user-determined pace, and through user-determined content and applications.

III. Baseline Investigation

Low-income urban workers largely live in the city's less developed residential settlements with many working as part of the informal economy. A large share of these workers are young and recent urban migrants. Given low levels of education or low-quality education, they are mostly employed in low-paying service sector jobs or work as small entrepreneurs. Among this group, some workers find jobs at formal office facilities, often associated with slightly higher pay, additional perks, and more prestige. In Indian cities, these opportunities have mushroomed since the early 1990s, as both domestic and multinational corporations expanded operations and facilities.

Unfortunately, these workers have limited opportunities to upgrade skills or learn new ones, especially within their workplaces. The training institutes that exist, for spoken English, typing, or IT skills, place heavy demands on workers' time and finances, as they require attendance at external training centres. As a result, even after decades of labor,

workers earn only marginally better incomes than when they started.

Our pilot focused on the service staff at a single urban corporate facility in India's IT capital, Bangalore. The facility employs around 55 full-time employees and 35 support staff at any given point in time. The latter group consists of housekeeping or cleaning staff, drivers for the office cabs, security guards stationed at the facility's entry and exit points, and building maintenance staff to monitor the facility's electricity, connectivity and other infrastructure.

Prior to the pilot, we conducted detailed structured interviews with nearly all of the facility's support staff (a sample of 30 respondents out of a total group of 35 workers), to understand their baseline socio-economic characteristics, occupational history, current job requirements, use of technology and aspirations. Each interview lasted for 60-90 minutes. This was complemented with participatory observation of work routines. Of the many insights gained from this qualitative investigation, a few are described below.

The average age of the support staff is 26 years, and the average worker had ~12 years of formal schooling (class 10). All except two are men: many have migrated to the city alone in search of better work opportunities, even as their families continue to live in the village. The average worker earns ~$100 in income per month [20]. Depending on their job and the week in question, workers' shifts varied: security guards and maintenance staff rotated for a week each between a 9 pm – 7 am shift, 7 am – 2 pm shift, and a 2 pm – 9 pm shift; housekeeping staff rotated between 9 am – 4 pm and 12 pm – 9 pm shifts; and drivers worked 12 hour shifts from 10 am - 10 pm and 10 pm - 10 am. Workers had changed numerous jobs, despite having entered the labor force recently. One worker for instance had started out in the village doing casual wage-labor work, then worked as a private tailor, moved on to work at an export garments factory, then changed jobs to work at a finance company, after which he moved to corporate housekeeping.

In the course of their daily work at the office, workers regularly saw PCs but did not touch or interact with them, except to clean them. Their interactions were exclusively with the specific 'tools of their trade', involving coffee machines, vacuum cleaners, fax and photocopying machines, radios (for the drivers), and phones. A few workers had occasional interactions with a PC at a cyber café, or at the office for a specific application, *e.g.*, managing the Building Management System or the Security Camera Tracking application. Such workers' general digital literacy skills were very low though – a result of their repeated restricted interaction with a single niche application.

Likely because they worked in an office full of PCs (a software development and research centre), PCs were dominant in the discourse of the workers' aspirations for themselves and their children. On a four-point Likert scale ('Not At All Important' to 'Very Important'), all except two respondents rated the computer as being either Important or Very Important for their own upward mobility, and all of them felt this way about the importance of computers for their children to get ahead in life. As one respondent claimed, "*Even if you are poor, if you learn computers and try and get used to it - you can improve*" [21].

Yet, though considered critical at a conceptual level, functional understanding of the PC was limited and based on workers' observations from mass media and their environment. One worker's comments on the PC as a learning device aptly captures this lack of a clear functional understanding, "*Students now learn Windows - how to open it and use it, what's inside it, games, etc. - and I can't say why exactly that is useful, but it is. I know there is something in the computer that is important for students*" [21].

A few workers who had learned to use particular applications meaningfully on a PC had done so through instruction from their peers or seniors at a past workplace. They described having picked up these skills through a combination of observation and 'learning by doing'. As one respondent described, "*I learned to use Outlook from my boss here. I had learned to use Excel at my previous job at a travel agency – a lady colleague taught me there. I learned to browse the internet after observing how my friends did it. I learned to do personal email on my own.*"

IV. Solution: Kelsa+

In response to the expressed desires in our baseline qualitative study, we introduced an Internet-connected PC at the workplace for the exclusive and free use of the facility's support staff, to be used during workers' off-duty hours. The project was named Kelsa+, with 'kelsa' being the local language (Kannada) word for 'work'. Kelsa+ was, therefore, meant to signify 'after-work', 'beyond-work' and 'improving-work'.

The intervention involved three overlapping phases of activity: (1) a 'Hole-in-the-Wall' phase inspired by the NIIT studies, when we were just observing what workers did on the PC when left on their own, (2) a Learning Modules phase, which involved trying different things to improve productive value of the PC for the workers, and (3) a Pre-Expansion phase, when we conducted interviews with management at other firms to understand what issues we'd need to address to make Kelsa+ work in different office locations. We describe each of these below.

A) Phase One: An Office 'Hole in the Wall'

The first phase involved establishing the four basic components of the project. First, a worker-dedicated PC was set up and integrated with existing company structures to have full infrastructural and institutional support. The PC had a basic Windows XP Operating System and the Office 2007 suite of applications installed. It had a dedicated broadband internet connection, as well as peripherals such as speakers, headphones, a printer and a webcam. User log-in on this PC was disabled to minimize barriers to entry, so that a worker could begin interacting with the PC as soon as s/he sat in front of it. That the maintenance of this PC would be handled by the company's regular IT staff was also established.

Second, the Kelsa+ PC was set up in the office's basement,– a space that housed the maintenance office, the workers'

changing rooms, the office cars, etc, and so was shared by all the service staff. The fact that it was placed in a location that was primarily "owned" by the workers and in which they felt comfortable was deliberate. Had the PC been placed in the cafeteria or in the lobby of the building, workers might have used the facility less, in deference to the office's full-time staff. In some ways, this placement choice of using a space that the target group felt comfortable accessing was probably just as important as the 'Hole in the Wall' project's decision to place their kiosks near schools and outside of buildings. As a worker later affirmed, "*When the computers are inside, it is difficult for us to feel comfortable touching them. Now, this is like a computer for us, outside* [in the basement]" [20].

Third, in a set of initiation activities, the PC was introduced to the workers as a facility that they could use for any purpose whenever they were off duty. Workers were informed that all activities on and around the PC would be recorded, both for research and security purposes, specifying that none of this material would ever be used to restrict usage. Signage in the local language and English indicating this logging was also placed at the Kelsa+ PC location. For any questions or concerns, two of the authors were pointed out to the workers as the people to contact.

Finally, the determination of who would use the PC when and how was left entirely to informal processes of negotiation between workers. No schedules were drawn up. No instructions were given. That usage and learning was entirely voluntary and self-paced was established. No restrictions were laid on how many users could simultaneously work on the PC. The intent was to provide a wide open area, conducive to groups of peers interacting with the PC together.

B) Phase Two: Learning Modules

After a year of allowing unrestricted usage of the PC, we collected feedback from the workers in a series of focus group discussions. Strong interest was displayed in achieving particular kinds of learning using the PC, including learning English, office productivity software, and accounting software (*Tally*). To further this goal, we started by introducing English as a Second Language (ESL) content, both as CDs and compiled weblinks, to the workers. No formal instruction was given or classes were taken. The voluntary and self-paced learning nature of phase one continued. We only acted as initiators of introducing new content at the Kelsa+ PC towards a specific productive goal, and not as evaluators or routine instructors.

C) Phase Three: Management Discussions

Kelsa+ is housed within an institutional context, and we made an effort to understand the effect that the intervention was having on its social and institutional environment, to avoid some of the limitations that the Hole-in-the-Wall study had faced. As we continued with other explorations on Kelsa+, we collected feedback from management to understand their reactions to the Kelsa+ facility for workers. We also began a set of investigations to understand what it would take to expand the project from a small-scale pilot at one office location, to multiple sustained deployments across various firms. For this, the project was consolidated as a 'Corporate Social Responsibility' initiative, and proposed to a number of major corporations in Bangalore. Senior management at these firms were interviewed in relation to their own service staff populations. This data was used to compile a variety of solutions to the expressed concerns, so that the project could possibly fit into other institutional contexts.

V. STUDY METHODOLOGY

We employed a mixture of research methods in studying Kelsa+ through its three phases of activity, which we describe below.

Collective usage: quantitative metrics

The Kelsa+ PC had a logging application installed, which tracked all events initiated on the PC [22]. This included launches of all applications, as well as URLs visited. The logging tool also allowed an examination of how much time users had spent on the Kelsa+ PC on any given day. These three metrics (collective time spent using the machine, applications used, websites visited) were recorded over the 18-month period (Jan 11, 2007 – June 2 2008), with the analysis conducted on consecutive fortnights of activity. Application and internet usage was measured using number of launches as well as active time spent on each application/website. There were two breaks in logging, one when the PC's connectivity was interrupted in mid-November 2007 and the other in late-March 2008 when the PC's OS was re-installed, both in response to virus attacks.

The categorization of the log data into meaningful groups, including application categories and website categories, was performed based on the researchers' examination of keywords that tagged the data optimally despite the heterogeneity of usage. These are available on request from the authors.

Collective usage: qualitative measures

The activities on the Kelsa+ PC were also recorded using a screenshot logger, with a screenshot of the PC taken every minute. In addition, the activities around the PC were recorded using a motion-detecting web camera. These screenshot and video logs were processed manually, and hence, selectively, to answer specific questions around usability, group usage/sharing dynamics and number of distinct users. For the latter, 14 days of video logs were randomly picked from the 18-month study period to estimate the average number of distinct users per day.

Individual impact: quantitative metrics of change

Given the high job turnover rate among workers in this segment (described in the baseline study's results), longitudinal tracking, i.e. measurements for the same individual over time, was very challenging. However, for a limited subset of workers, we obtained before and after results for particular behavioral or proficiency tests and these cases were used to understand possible patterns of change. These included the following tests:

- *A Self-Esteem questionnaire*: A local language-translation of the Rosenberg Self-Esteem questionnaire [23] was administered to a sub-set of workers prior to the Kelsa+ intervention (17 workers), and then five weeks after it was introduced (27 workers). Eleven respondents overlapped between the two administrations (0.65 of pre-test group). The differential in scores obtained for these workers was calculated.

- *A Digital Literacy test*: A brief digital literacy test covering usage of basic applications on the PC was administered prior to the introduction of the Kelsa+ PC (30 workers). The time taken to complete a task, as well as the number of prompts needed to complete the task, were recorded as metrics of proficiency. The same test was administered to three workers, 18 months after the intervention, of whom two had taken the pre-test as well. The differential in scores obtained for these workers was calculated. Normal staff turnover at the rate of ~2 workers per month had disallowed a pre- and post-test comparison for more workers over this extended time period.

- *An English proficiency test*: An adapted version of Cambridge University's 'Key English Test' for Beginners [24] was administered to a sub-set of workers first in March 2008 (20 workers), prior to the introduction of the ESL digital content. A second test in the same format was administered in August 2008 (17 workers), after over three months of the ESL material having been available for workers' usage. The questions focused on testing basic English vocabulary, grammar, and reading comprehension. Seven respondents overlapped between the two administrations (0.35 share of pre-test group). The differential in scores obtained for these workers was calculated. The post-test also asked a few questions on workers' Kelsa+ usage or non-usage over the week preceding the test.

Individual impact: qualitative narratives of change

A subset of the staff from across workgroups (6 workers, ~0.17 share) was interviewed in detail 18 months after the intervention was launched. These workers discussed their background, prior exposure to a PC or not, their usage of the Kelsa+ facility, and their present job, following a structured interview protocol. Their perceptions of change since the introduction of the Kelsa+ PC were also recorded. The results from this analysis describe socio-economic mobility pathways associated with usage of the Kelsa+ PC.

Management interviews

We conducted structured interviews with five facility managers at the pilot location (across transport, security, housekeeping, etc.) and recorded their observations around the Kelsa+ intervention including: the usage patterns of workers, any effects on worker productivity (positive or negative), any other changes in service staff behavior or work since PC access was given, etc.

To assess the relevance of Kelsa+ in other institutional contexts, over 15 corporations were contacted from a range of sectors (biotechnology, energy, IT) with the majority being IT firms. They were first briefed about the Kelsa+ concept. Structured interviews were then conducted with them in which they shared details on the size and composition of service staff at their facilities, their evaluation of the possible benefits from, as well as concerns around, implementing Kelsa+ as a CSR initiative for the service staff at their facility.

VI. Study Results

Given the multiple research methods that were used, in this section we present our results in correspondence to thehigh-level categories described in the methods section: collective usage,individual impact and management feedback.

VI.I Collective Usage

Time used

After the initial fortnights, the Kelsa+ PC saw high and sustained adoption by the support staff (Figure 1), recording average collective usage of 10.13 hours per day. Usage peaked at 17.83 hours per day in fortnight 29. Further, usage was not restricted to a small minority of persistent users, but was spread across a broad base of workers. From the video log analysis, we found an average of 13 workers to be primary users of the PC each day, with all staff workgroups represented in the user base. 40 unique workers were observed using the Kelsa+ PC at least once (despite a staff size of only 35 at any given point in time – this occurred due to staff turnover) during the sampled period. A quarter of the workers were identified as high-frequency users, seen using the PC on half or more of the observed days [19].

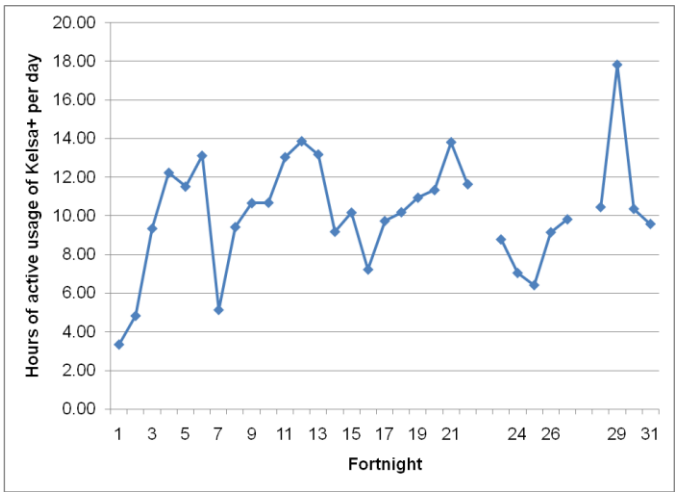

Figure 1: Hours of active usage of the Kelsa+ PC per day (average over each fortnight)

Using a different measurement instrument, the responses to the questions on Kelsa+ usage or non-usage included in the second English proficiency test revealed that all but two workers in the sample (0.88 share) were active users of the Kelsa+ PC. They reported using it on an average of 4 days in

the week preceding the test, and for an average of 60 minutes per sitting.

Usage dynamics

The applications and content accessed on the Kelsa+ PC changed over the study period. Figures 6 and 7 (on pp. 13) showcase the changing distribution of application and internet usage over 31 fortnights.

Initial application usage was spread evenly across the gamut of available software on the PC, indicating heavy exploratory usage. However, starting in the third fortnight, Internet Explorer becomes the dominant application launched, followed closely by multimedia applications. There is a shift away from basic interactive applications that are very popular initially (Microsoft Paint and offline games, whose usage fell from 15% to 0), to increased usage of the Internet with its dynamic content and more sophisticated applications.

As Figure 7 shows, workers spent many months primarily using the internet for entertainment – viewing music videos or films on YouTube or Stage6. However, we see a rise in using the Internet for communication, through email and social networking sites like Orkut, eight months after the project was started (correlated with 6 workers simultaneously creating email accounts at this time).

There is a strong motivation to use the computers for self-expression, as Figure 3 shows. The ability to create a personal digital presence, both through images and later through email, was a source of great pride among workers, and seemingly altered the way they perceived themselves.

Learning

Workers followed individual and group learning paths. Several workers simply observed their peers using the PC for weeks before attempting to touch the PC themselves. As one worker commented, "*For the first one and half months, I just watched how other people used the computer*." We asked why he did this without trying to use the PC himself, to which he responded that "*what if something happened when I used it?"* [19] Observation and individual exploration established 'learning by doing' routines, which were instrumental to meaningful PC literacy gains.

Figure 2: Combination of workers observing and being primary users themselves

Group usage of the Kelsa+ PC was very popular; in fact, some users actively sought out colleagues with whom to use the PC. Peer learning sometimes took the form of an informal teacher-student relationship for a particular task or application. For instance, as [19] describe, "many workers had gone through the email account creation process with a peer who was an existing email user. During the registration process, in the space where a second email address was required (usually of the person creating the account), the experienced email user friend would enter his email address, since for most workers, this was their first email account." For other workers, group usage involved a symbiotic learning relationship: "*I use it with a friend generally, so that we can learn from one another. What he doesn't know I tell him, and vice versa.*"

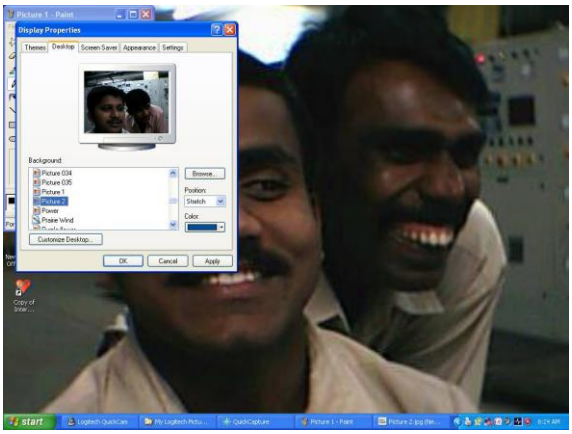

Figure 3: Workers creating personalized desktop backgrounds using the Kelsa+ PC's webcam

Usability preferences

Given their educational and linguistic background, workers' revealed a number of adaptations in input techniques to achieve functional use of the PC. Navigation using a mouse dominates since typing is problematic. Browser history is repeatedly used as an easy way to access content of choice, indicating implicit peer learning [Figure 4]. Search queries (with the ".com" tag) are repeatedly used to access online content within and across sites, given that it involves only memorizing and typing in one keyword or a short phrase, as opposed to an entire url. Email forwarding is the dominant method of online communication, with one user forwarding up to 15 emails per day to 10 or so people (mostly images).

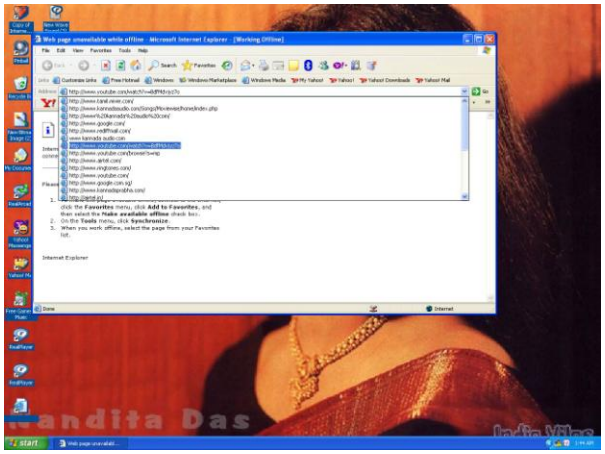

Figure 4: Browser history is repeatedly used as a way to access content without typing out URLs

VI.II Individual Impact

A) Self-esteem and confidence gains

The 11 workers who took the self-esteem test just before the Kelsa+ intervention and five weeks after its installation, recorded a 5% jump in their self-esteem score. This change clearly cannot be attributed just to the PC installation without a control group. However, qualitative interview responses from workers appeared to reiterate the effect that the Kelsa+ PC had had on individuals' sense of hope, confidence and self-esteem. One driver commented, *"I see some changes in my life – I couldn't speak English before, now I can speak a little… I haven't yet changed my job or used English outside, but I now have some hope to learn… I have that courage."* Further, use of the Kelsa+ PC was seen as a first step towards further possibilities: "*To do any computer course outside, I think I should know some basics.... having picked up some basics today I have the confidence that when I take up a course... I will be able to catch up ... and I am very inspired by using the PC here to know more and learn."*

Given that the Kelsa+ PC was in many cases the first time a worker had touched a PC, it elicited responses such as: "*I felt so happy that day when we had the interview. For the first time I touched a computer and did so many things without a mistake….. I don't have an email account. So now maybe I can make one on this computer."* [20] The continuous access to a PC at a location that workers visited everyday lowered the barrier to usage considerably, "*Since, the computer is here, we get awareness! Also because we can see the computer daily ....my desire to learn and use it has increased very much."* And all this of course translated into changes in how workers viewed their workplace: "*In all my service, this is one of the best workplaces I have seen*."

B) Digital literacy gains

Two workers, a housekeeping worker and a driver, with minimal prior PC exposure and varied demographic characteristics, were administered PC literacy tests before the Kelsa+ intervention and 18 months after it was initiated. Churn in workers and the small sample size, curbed such a pre- and post-test for a larger share of workers. Such testing would be essential to establishing average impact across workers. However, the results for these two respondents are encouraging, given their low educational attainment and given that in these cases we can clearly trace the digital literacy skill gains to workers' Kelsa+ PC usage alone.

Both workers had experienced gains in a core set of PC literacy skills (see Table 1). While they were unable to perform any of the tasks in the pre-test (save for turning on the PC), both were now able to open a web browser window, launch a search application, navigate through the results, and open and close a document-processing application.

Similar to the Hole-in-the-Wall gains for children, these measured improvements in digital literacy for two such demographically and occupationally distinct workers, from entirely voluntary and informal learning processes, are promising. Neither of these workers had interacted with a PC outside of the office during this time. Neither of them had been schooled in English. One of them had left school after class 7, the other after class 4. This only goes to show how despite the average educational attainment among the pilot location's service staff group being higher at Class 10, even those who had much lower levels of education in a local language saw gains in basic digital literacy from Kelsa+ usage.

Table 1: PC Literacy Test Results

	A		R	
Occupation/ Age	Driver/ 55		Housekeeping/ 23	
Education/ Medium of instruction	Class 4/ Tamil		Class 7 / Kannada	
Annual Income (US$)	$1600		$1000	
Previous PC Exposure	Never touched a PC		Had touched a PC before, but never used one	
Reported usage frequency	30-45 min each session; 3-4 sessions a week		30 min every day	
Key applications used	Local-language news portals, games, local-language music and films		Local-language music and films, email, games	
PC literacy scores	Pre-	Post-18 mths	Pre-	Post-18 mths
Turn on the PC	?	✓	✓	✓
Play Windows (offline) Games	X	✓	X	✓
Open Internet Browser and go to a search engine	X	✓	X	✓
Enter a search query	X	?	X	✓
Open the best search result and	X	✓	X	✓

go back to results list				
Sign-in to E-mail client	X	X	X	✓
Start MS-Word application	X	✓	X	?
Type in MS-Word	X	X	X	X
Save document	X	X	X	✓
Print document	X	X	X	✓
Close Word application	X	✓	X	✓
Shut down PC	X	✓	X	✓

✓ : Successfully completed the task
? : Partially fulfilled the task/ completed the task with extensive prompting
X : Does not know/ did not attempt
Source: [19]

C) Improvements in English proficiency

Over a 3-month period of Kelsa+ usage, the English proficiency scores for the seven workers who took both pre- and post-tests improved from 32% to 41%. Looking at their individual trajectories, we find that of the seven, four saw increases in their English proficiency while the other three saw declines. Yet, the increments upward (average movement of +19.4%, p=0.04) appear to be significant while the movements downward are not distinguishable from measurement error of the same proficiency level (average movement of -3.8%, p=0.13). This possibly indicates an interaction between individual worker motivation or initiative and the availability of the PC-based learning material, to produce differential skill gain outcomes. A key issue is, therefore, the need to understand motivational tools that might make available skill-development tools more widely used across all workers.

Table 2: English Proficiency Test Results

Overall	Test 1	Test 2	
Average score (%)	45%	53%	+8%
Sample size (n)	20	17	
Pre- and post-test cases (7 workers)			
Average score (%)	**31.7%**	**41.2%**	**+9.5%** (p=0.14)

D) Socio-economic mobility pathways

While the measured estimates may indicate gains in particular skills for select individuals, the true impact of such facilities would need to manifest as improved socio-economic outcomes for workers. Three cases illustrate the variety of ways in which these skill gains have translated into individual workers' 'development'. These workers displayed particularly high motivation levels, and their experiences are anecdotal. At best, their outcomes indicate the extent of welfare impact that is possible when worker initiative and circumstance interact with access to the Kelsa+ facility to produce welfare-improving outcomes.

Upward mobility within the same office

A housekeeping worker with a Class 7, local-language, rural government school education, and no prior exposure to a PC, began using the Kelsa+ PC for 60-90 minutes each day after his work shift. He used it for games, internet video, music, etc. A few months later, he created an email ID with the help of a driver colleague, began using the Learn-English CDs available at the Kelsa+ PC, and various Microsoft Office applications. He was given an initial typing job on MS Excel by the IT staff in the office, which he completed and submitted satisfactorily. He was then given additional inventory data entry jobs (on Excel), before being hired as a dedicated worker for the IT staff.

English skill acquisition

A driver with no prior exposure to a PC and a Kannada-medium government school Class 10 education, took an interest in using the PC for music, movies, as well as learning English, spending 2-8 hours of off-duty time per workshift on the Kelsa+ PC. He specifically requested an extension to stay in this job for a few more months (a number of drivers left the facility due to inconvenient shift changes at this time; contract workers are often moved from one location to another), since he had begun using the Learn-English CDs at the Kelsa+ PC and wanted to acquire a certain level of competence before having to leave.

Shift to a new career path

A security guard with a Class 12, local-language, rural government school education, sat at the Kelsa+ PC for 60-120 minutes before or after a shift. He used the Kelsa+ PC to practice typing as he underwent a data-entry training course outside the office. The practice afforded by access to the PC at the workplace was key, in his opinion, to his successful job interview for a data-entry job. He has since moved from his security guard job to a data entry position at another firm. His pride in his new job was reflected in his comments, "*Today I can stand up in front of my father and friends and say that I am no more a watchman, but I am doing a computer job."*

VI.III Management feedback

A) Managers at pilot location

The response from the management at the pilot location was strongly positive. They felt that such exposure to technology made their workers confident and knowledgeable, while also being a source of recreation. Moreover, they commented that providing a PC access facility for the service staff at the workplace had a special connotation for workers: "*sitting in a cyber* [café] *and learning and sitting in their office and learning is something different*."

Certain improvements in the workers' ability to communicate in English were described. In addition, some

workers had demonstrated initiative in integrating PC usage into their own everyday workflows. A worker in the housekeeping division, for instance, had begun to type up the weekly stock order list for the office pantries on MS Excel and was emailing these to his supervisor, instead of writing them out by hand (Figure 5).

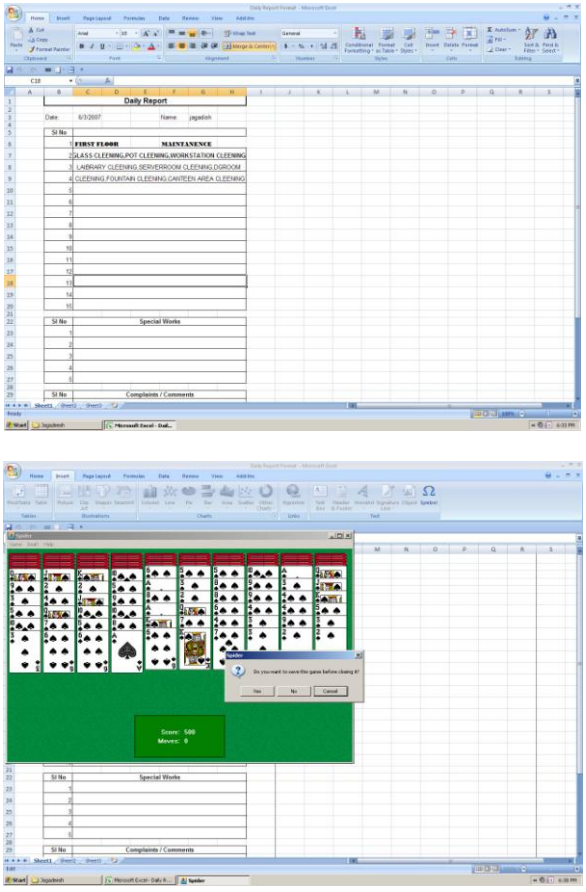

Figure 5 a and b: Housekeeping workers maintaining task lists on MS Excel at the Kelsa+ PC (even as they multitask with playing games)

B) Managers at potential implementation locations

The feedback from the fifteen corporations contacted as potential implementers of Kelsa+ facilities fell into two camps. One set of corporations saw Kelsa+ as a tool for their workers to learn English, which they considered a major factor in increasing workers' confidence and employability. The intervention would bring more equity and awareness to their service staff, and change the way they viewed technology and the world. As one manager commented, Kelsa+ is "*not just a little feel good project, but something that can have an impact if done right*." [25]

On the flip side, the managers at a number of other corporate facilities were very concerned about the potential risks of this intervention. Security of both physical equipment and content was perceived as the number one concern. Other perceived risks included difficulty in finding a suitable location for the PCs due to safety measures in some companies, risk of downloading or sending malicious or offensive content from the PCs, legal concerns regarding company liability, the risk of computers being used for entertainment purposes only, and the associated effort for regulation and supervision of usage being too huge for companies to undertake. [25] The fact that most of these workers are contracted and are not direct employees of these companies also contributed to reluctance by some corporations: "*These workers are not our employees so why should we educate them. Their employers may not like it.*"

In general cost was not perceived to be an obstacle in proceeding with Kelsa+ amongst most of the companies interviewed. Connectivity charges were considered the biggest cost component, but procuring PCs for the initiative was not perceived to be an issue.

VII Discussion

In proposing Kelsa+ as a potentially effective ICT4D intervention for low-income office service staff, we return to the related work in this field and discuss this intervention's comparative strengths and limitations.

(1) Extending 'Hole-in-the-Wall' possibilities

Similar to the HitW intervention, Kelsa+ highlights how acquiring basic digital literacy skills has little to do with socio-economic background or educational quality, but much more to do with immersion, practice, and learning by doing. Persistent and minimally-invasive access to the PC for workers' continuous exploration in the office environment through Kelsa+ has allowed for the following primary benefits:

(a) **Improvements in basic digital literacy**, including the ability to turn a PC on, operate an input device effectively, identify various applications, and navigate through the web to preferred content.

(b) **Improvements in English proficiency**, driven not only by the use of dedicated ESL content, but also by the workers' repeated interaction with English language content on the web, and sporadic use of email and office productivity tools.

(c) **Improvements in hope, confidence and self-esteem**. Kelsa+'s achievement lies in its demonstration of how easy PC usage can be, and its encouragement to workers to believe that they can learn more as they work and at no additional cost. Should this hope translate systematically into real outcomes manifested in test scores, or new jobs, workers will be further inspired to experiment and learn, thereby establishing a virtuous feedback loop.

In a departure from the HitW studies, Kelsa+ also explores the effects of the intervention on the institutional context that houses such an intervention. The pilot office facility saw greater staff morale and attachment to the workplace from having such a recreation and learning facility at the office. Worker initiative to incorporate the Kelsa+ PC into their work routines was welcomed. Managers responded positively to improvements in worker confidence and

knowledge, and to enhanced worker capacity through improved digital literacy and communication skills.

At the same time, it is unclear whether these dynamics of security, productivity, and open exchange seen in the pilot will repeat themselves in other Kelsa+ locations. For instance, restrictions in the timings that workers can stay at the office facility, before or after their workshifts, will indeed influence the extent to which they can experiment with the PC and gain from access. Resolving such issues will involve political bargaining between stakeholders, a process inherent to the effective design and implementation of any sustainable ICTD intervention [26].

(2) Slow and sustained wins the race

What makes the Kelsa+ installation any different from other telecentre/ kiosk or digital literacy initiatives in developing countries? There are three key aspects of the Kelsa+ system's design that distinguish the user experience it offers low-income service workers from other similar ICTD initiatives:

(a) Availability and support: The office environment provides 24x7 availability and all the necessary infrastructural, technical, social and financial support required to sustain the health of the PC for the workers. Skilled maintenance is always at hand, more experienced users are all around to ask for advice, and the institution is already an integral part of workers' daily routines. As a result, the barrier for workers to begin experimenting with the PC is considerably lowered.

(b) Digital habituation: Interaction with the Kelsa+ PC has no fee and is not limited in any sense. This allows workers to respond to the PC spontaneously and evolve behaviors incrementally as they build skill. Workers engage in a slow process of familiarization with the technology as they learn basic navigation techniques and understand what the technology can be used to achieve (or not) and how; a process [19] term 'digital habituation'. Such habituation "constitutes a critical intermediate step between providing PC access to a disadvantaged community and achieving sustained development impact." [19]

(c) Learning by doing / learning through peers: An advantage offered by the Kelsa+ PC and usually not available at regular telecentres, formal IT training institutes, or libraries, is the ability to learn passively and informally from peers, in addition to learning actively through doing. As a security guard who had done two years of computer courses at a government college noted: "*They used to teach us basics…but I didn't pick up much from the class… I generally learnt things on my own after coming here...once I see some people using* [certain applications or features] *....and then next time I generally go about following the same.*"

(3) Low marginal cost for well-endowed providers

In the PC kiosk franchise arrangement, there is often an entire livelihood, that of the kiosk operator, depending on the success or failure of the PC kiosk business. In contrast, one of the major advantages of Kelsa+ is that it is an intervention that costs marginally nothing to those financing and running it, i.e. large private corporations. The providers in this case already manage large IT budgets and maintaining an additional set of PCs has a negligible cost.

The Kelsa+ intervention involves a set of basic components, with the major costs being the upfront capital expense for the devices and software (operating system, internet browser, office productivity suite, anti-virus application). Additionally, there are monthly connectivity charges.

There exist several procurement and connectivity options that determine the final cost of a given Kelsa+ facility. For a Kelsa+ facility with 40 workers, with capital costs amortized over a 3 year period, the monthly cost can range from $3.4 per worker (when a new PC is purchased, Microsoft Office is installed, and a 512 Kbps Unlimited Data Transfer connection is used) to $1.3 per worker (when a refurbished PC with Open Office is used, over a 256 Kbps Unlimited Data Transfer connection) [25].

(4) Development through 'agency' enhancement

A key aspect of the Kelsa+ intervention is the freedom that accompanies exploration on the PC. The opportunity cost for workers to invest in their own learning is minimized through free access and convenient placement of the PC within their workplace. More importantly, by refraining from any restrictions on workers' access to particular applications versus others, the agency of the worker is respected and encouraged in determining particular usages of the PC that meet his/her need [27].

Kelsa+ encourages a peer-learning model, through which workers with heterogeneous exposures and skills are allowed an opportunity to share their knowledge at a location where they congregate organically, i.e., the work place. Learning is driven by the user's demands, and when not met by peers, workers are able to consult employees with more knowledge or step up and draw from training courses offered externally. In all this, the worker is centre-stage and his/her decisions dictate usage and impact, which differs from more paternalistic interventions in the ICTD space where certain 'developmental' results are expected and deviations from those results are treated as shortcomings.

VIII Limitations and Ongoing work

Though based on a simple premise, Kelsa+ is a powerful idea because it takes the ICTD discussion and integrates it with the daily workings of mainstream institutions in developing countries. Many populations in need operate in or close to existing IT infrastructures. As Kelsa+ shows, the innovations needed to have technology be useful to such

groups are, therefore, mostly of political will, design, and process.

There are many shortcomings in the current study. The evidence presented is based on a handful of cases, and such anecdotal positive effects cannot be mistaken for large-scale systematic impact. It may well be that the workers whose results we have recorded are exceptionally motivated and do not form the norm in this segment. The facility where the pilot was implemented was in fact a small software development and research centre, which may have presented many unique conducive factors for Kelsa+ to take off, including caring staff, an environment of trust, ubiquitous IT presence, strong IT maintenance support, 24x7 access, and open policies regarding employee PC usage. The interview responses from the participants may also have been influenced by the peer relationship they share with the researchers, which would prevent the sharing of negative feedback.

It is clear that objectively verifying the value of Kelsa+ as a general ICTD intervention involves exploring it in a variety of institutional contexts. This is our ongoing effort. In extending the scope of Kelsa+ to become a systematic tool for socio-economic mobility among urban low-income office service staff, our current efforts involve emphasizing longitudinal tracking of workers to map welfare impact, deploying Kelsa+ in non-IT corporate facilities, introducing some structured learning components to test their effect on learning outcomes and worker welfare, introducing certification options to prove skill acquisition externally during job-search, offering supplementary income generation possibilities for simple mini-tasks completed at the Kelsa+ PC, understanding the specific constraints that prevent women workers from using the Kelsa+ facility, and testing motivational tools that might influence the usage of the PC for explicit skill-building across domains and workers.

This study draws the ICTD community's attention to a sub-set of the poor who spend the bulk of their time around sophisticated IT infrastructures, but so far, do not gain from such proximity. We have described a pilot implementation of the Kelsa+ project in an office facility with 35 service staff, among whom the average worker earns $100 a month and has studied till class 10 in the local language. Over a period of 18 months, we saw broad improvements in workers' confidence, self-esteem, and basic digital literacy, while a few individuals experienced increases in second-language (English) proficiency and career opportunities. Verifying these results through larger-scale and wider-scoped Kelsa+ implementations and measurements is now necessary to build on the promise of this simple, cost-effective, yet powerful ICTD intervention.

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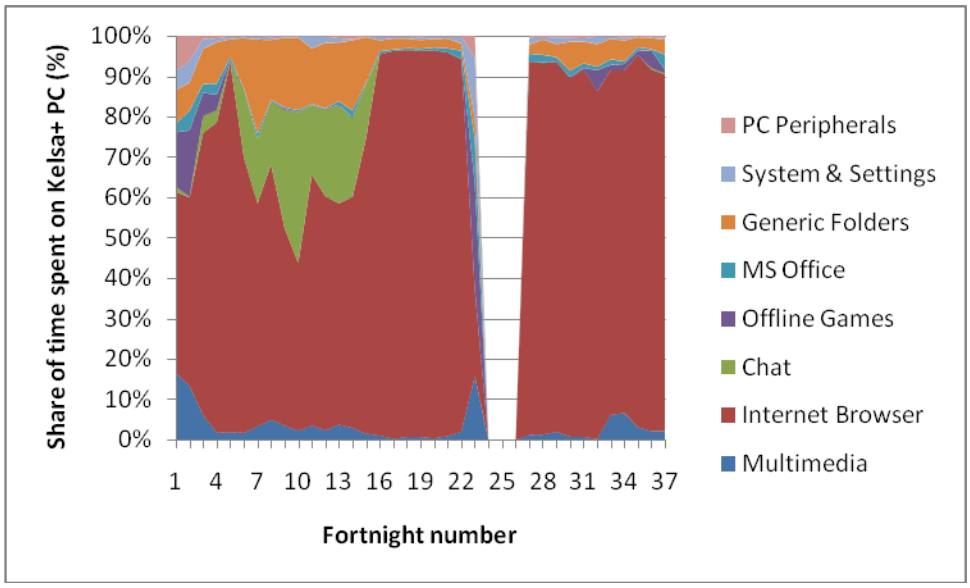

Figure 6: Distribution of applications used at the Kelsa+ PC over 18 months. Dominance of internet usage can be clearly seen. Decline in use of applications like offline games also seen.

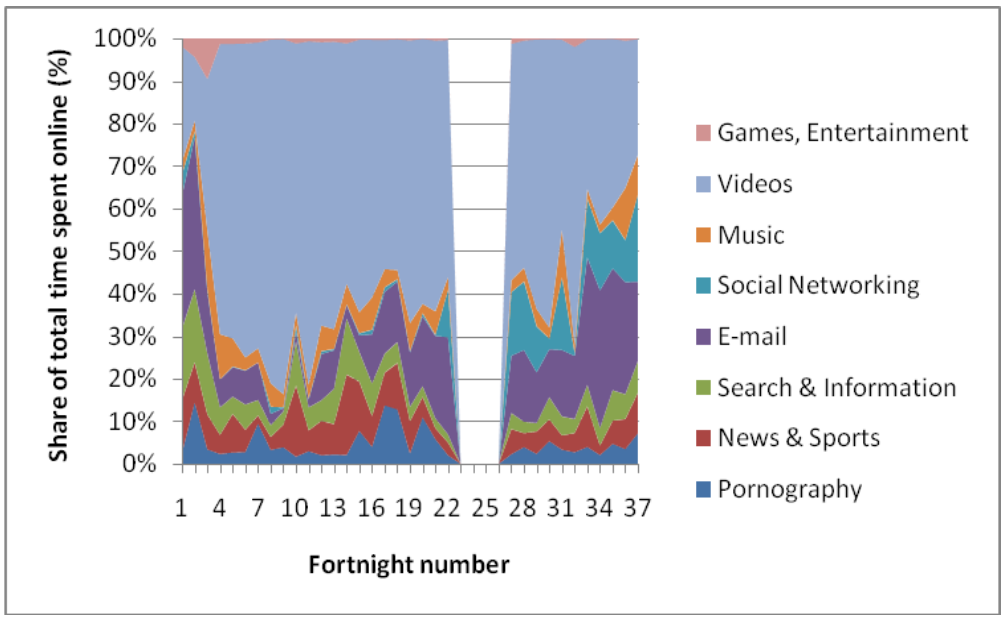

Figure 7: Distribution of internet usage at the Kelsa+ PC per fortnight over 18 months. Increase in Internet video usage is clear. Steady and high usage of email is seen after fortnight 15. Social networking websites see increased usage starting in fortnight 21.