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Public Computing Centers in Texas

Policy Research Project

By

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List of Abbreviations and Acronyms

Anatel: National Telecommunications Agency

ARPA: Advanced Research Projects Agency

ARPANET: Advanced Research Projects Agency Network

ARRA: American Recovery and Reinvestment Act

BcN: Broadcast Communication Network

BDT: The Telecommunication Development Bureau, the operational arm of the International Telecommunication Union

BTOP: Broadband Technology Opportunities Program

DARPA: Defense Advanced Research Projects Agency

DC: Demonstration Centers

DSL: Digital Subscriber Lines

FCC: Federal Communications Commission

FUST: Fund for the Universalization of Telecommunication Services

HCL: Houston Center for Literacy

ICT: Information and Communication Technology

ITU: International Telecommunications Union

KADO: Korean Agency for Digital Opportunity and Promotion

KERIS: Korea Education and Research Information Service

LGT: General Telecommunications Law

NIA: National Information Society Agency

NTIA: National Telecommunications and Information Administration

OECD: Organization for Economic Cooperation and Development

PCC: Public Computing Center

PGO: Brazil's General Concessions Plan

PSI: Programa Sociedad de la Información

SBA: Sustainable Broadband Adoption

SBDD: State Broadband Data and Development

TEAL: Technology Expertise, Access and Learning for all Texans

TENET: Texas Education Network

TIF: Telecommunications Infrastructure Fund

TRAI: Telecom Regulatory Authority of India

TSLAC: Texas State Library and Archives Commission

TXC2: Texas Connects Coalition

WIC: Women, Infants and Children

Chapter 1: Introduction

With a significant and steady minority of the United States population still "offline," or excluded from participation in the Internet for reasons of access, availability, and perceived need or motivation, the question of how to close the divide between those who have access and those who do not still persists. As an attempt to bridge the digital divide in the United States of America, public computing centers (PCCs) create resources to enable underserved populations to benefit from computer and Internet connectivity. The PCC model provides computer technology, Internet access, and most importantly trainers who provide assistance to underserved populations to help them navigate through technology that can frequently be intimidating or unfamiliar. In the state of Texas, the Texas Connects Coalition (TXC2) is at the forefront of providing connectivity across Central and South Texas through PCCs as part of a federal grant under the aegis of the Broadband Technology Opportunities Program (BTOP) that is funded by the Department of Commerce's National Telecommunications and Information Administration (NTIA).

The TXC2 PCCs were part of a 9-month study during the 2012-2013 school year by a group of graduate students as part of "Digital Inclusion" -- a policy research project at the University of Texas at Austin. Led by Professors Sharon Strover and Kenneth Flamm, the project began in Fall 2012. The first part of the course involved reviewing literature to understand various projects across the world to understand how different countries grappled with issues of digital literacy and access. Building on class discussions and preliminary visits to PCCs, the students then embarked on original field research to

assess and analyze the functioning of PCCs from the perspectives of three prominent stakeholders: the PCC clients, staff and trainers at the PCC sites, as well as institutional interests and policymakers invested in the program.

This paper documents the findings of this research project. We begin by first presenting an overview of international efforts in expanding broadband access and outlining the history and structure of BTOP specific to the interests of this study. We then detail the project's methodology that drove the data collection efforts. The heart of the research, however, and of this document, relates more immediately to our work in the Texas field. This spring we visited eighteen of the coalition's ninety-two sites in rural and urban central Texas. There we interviewed over eighty PCC users as well as thirty-four Texas Connects Coalition administrative staff and trainers. We also collected and deciphered usage data and browser logs in order to get a sense of when, how, and how frequently computers were used across and amongst PCC sites. Two distinct observations emerged right away. First, access necessitates both infrastructural support and computers – neither suffices on its own. And second, accessibility requires training and user services.

Addressing the institutional makeup of the Texas Connects Coalition members, we discuss PCC ecosystems composed of internal and external communities and networks, successful forms of outreach, and the present potential for wireless and mobile access. We also describe the variety of users we met in terms of digital literacy, training requirements, and their interactions with PCCs as constructed social, cultural, and

informational sites. Just as important as the variety of PCC functions and services is the variety and complexity of user needs.

Chapter 2: Public Access to ICTs: An International Comparison

In our very first attempts at understanding the different experiences in making public access to ICTs viable, we studied digital access, broadband, and mobile penetration within six countries – Argentina, Chile, Brazil, the United Kingdom, India, and South Korea – to draw a comparison across world regions. According to the International Telecommunications Union (ITU), within the developing Latin American countries of Brazil, Chile and Argentina, we found that computer ownership in homes lags behind home Internet access. This contrasts with digital home access in Korea, where 97.2% of homes have Internet access while 81.9% of the population owns a computer. Home access rates within the United Stated and United Kingdom are relatively equal (see Figure 1.)

Additionally, the percentage of the population using the Internet within each nation varied significantly among world regions (see Figure 2). With a high percentage of individuals online, the United States, United Kingdom, and South Korea – with 78%, 82% and 84% of their population online, respectively – are far more connected than emerging Latin American countries of Chile, Argentina, and Brazil, with 54%, 48% and 45% of their population online, respectively. This is especially true in the case of India, where only about 10% of the population utilizes the Internet.

Country Overviews

Argentina

In 2010, broadband among the Argentine population of 40 million people reached about 4.5 million households, which was a 30% increase from 2009.[1] According to the ITU, Argentina had 13.694 million Internet users in 2009 and an Internet penetration of 34% the same year. As of 2011, 47.7% of residents had access to the Internet, up from 25.9% just 4 years prior in 2007.[2] In 2010, Argentina President Cristina Fernandez de Kirchner introduced the National Telecommunication Plan, *Argentina Conectada,* as an effort to improve communication infrastructure and services. The plan included an effort to provide digital television broadcasting to citizens as well as to extend Internet connectivity to public school students and residents in remote parts of the country, partly through the establishment of communication technology centers. The end goal was to expand broadband access to more than 10 million households by 2015.[3]

According to a report by the International Trade Administration of the U.S. Department of Commerce, Argentina privatized its state telecommunications entity and initiated various deregulation policies on the telecommunication industry before the end of 2000. To continue the growth of Internet use among Argentines, *Argentina Conectada* included $1 billion for a 12,000-kilometer (7,456-mile) fiber-optic network to provide the infrastructure that would help expand broadband Internet access as well as "free-to-air"

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1 International Telecommunication Union, 2011
2 The World Bank, 2012
3 International Telecommunication Union, 2011

digital television across the nation.[4] *Argentina Conectada* also established public Internet access centers in pre-existing community centers (Glickhouse, 2013). Running parallel to *Argentina Conectada*, another program *Conectar Igualidad* also began in 2010, with the goal of providing public high school students with free computer equipment to address the digital divide and provide additional learning opportunities. As of February 2013, over 2.2 million computers have been awarded to public high school students within Argentina (Glickhouse, 2013).

Many other countries' telecommunication plans include detailed outlines pushing collaboration between the public, private, and nonprofit sectors. Argentina's National Telecommunication Plan, *Argentina Conectada*, included financial incentives to local private operators as a way of encouraging them to establish public Internet access centers.[5]

An especially unique collaborative public computing effort was made through the company Intel and its Intel World Ahead program. Via hands-on collaboration with governments, telecommunication providers, technology companies and other organizations, Intel World Ahead worked to increase access to digital devices, the Internet, and local content in rural San Luis, Argentina.

Running parallel with Argentina's national plan, *Argentina Conectada,* the ITU Telecommunication Development Bureau (BDT) and Secretar*ía* de Comunicaciones (SECOM) began a $3 million project in 2010 to provide access to broadband to a larger population. The Programa Sociedad de la Información (PSI) aimed to provide access to

[4] International Telecommunication Union, 2011
[5] International Telecommunication Union, 2011

ICTs in public spaces, like community centers, in an effort to "reduce the digital divide." As of 2011, 19 centers were being equipped throughout Argentina. Each center has a computer lab and training lab. They include a Wi-Fi room, where those with their own computers can use the Internet and an Audiovisual room with access to free "digital terrestrial television." The centers also include the latest generation game consoles.

In the case study of San Luis, Argentina, many of the inhabitants have neither had Internet access at home nor public access in their communities. Telecommunication giants have concluded that to build broadband platforms in these areas would not improve their bottom line. As a result, the economic development of the San Luis population was at risk from not growing its agribusinesses or farms. Hence, the Intel World Ahead Program partnered with the provincial government to provide Internet access to computer technology and technical training to this digitally ignored community. Argentina has one of the highest broadband penetration rates, but is battling with challenges that cause it to rank 106th out of 182 countries with an average download speed of 4.30 Mbps (megabits per second); only a third of the 13.05 Mbps international average (Mount, 2013). According to a study by the Center for Technology and Society at the University of San Andrés, despite Argentina's increasing high broadband penetration rate, the quality of the connection is poor and remains expensive to the average Argentine due to a combination of the fast-paced boom of Internet and mobile web users and years of low investment in digital infrastructure (Mount, 2013). Because of this, the Argentine workforce must conduct business using inconsistent bandwidth.

Communication programs like Skype are unreliable, and the exchange of files between co-workers can take up to 15 minutes and result in corrupted files (Mount, 2013).

The most inexpensive fixed Internet household plan is around $46, compared to $15 in Brazil, and only allows an average of 6.4 megabytes download speed. Argentines currently have two options for fixed Internet: DSL through their local phone company or broadband through Grupo Clarin. Group Clarin is currently in a battle with the Argentine government, which is threatening to take away their license to operate its broadband arm, Fibertel. Therefore, Grupo Clarin is not making large investments in digital infrastructure, and local phone companies do not have competition driving investment. If Argentina, and Latin America in general, decreased its broadband fixed costs by 10%, it would result in a broadband penetration increase of 22%, according to a survey conducted by the Center for Technology and Society at the University of San Andrés.

The current mobile Internet challenge is a result of the Argentine government's decision not to allocate the communication spectrum that has been internationally opened for broadband 3G mobile use. The government has also said that it would auction off the new spectrum, causing mobile providers to wait on investing in mobile towers that would use the spectrum more efficiently.

Brazil

The growth of the Brazilian ICT market has been substantial. By 2012, there were more than 100 million computers and laptops in use in Brazil (Jensen, 2011). According to the statistics provided by The World Bank and ITU (2012), about 45.4% of households had computer access and about 37.8% of households had Internet access at home in 2011.

The individual fixed-broadband subscriptions have also risen but to a lesser extent. However, Brazil is still below US and European levels in terms of various types of ICT access. The universal service goals in Brazil were first proposed in the General Telecommunications Law (LGT) passed in 1997, which established the National Telecommunications Agency (Anatel). Anatel is an equivalent of the US Federal Communications Commission (FCC). It was created to regulate the privatization of previously state-owned telecommunications company Telebras, as the state monopoly model cannot provide enough investment to match the demand for telecommunications services (Cunha, 2012). The Ministry of Communications is responsible for formulating public policies for the ICT sector while Anatel implements those policies. In 1998, Brazil's General Concessions Plan (PGO) clarified that only fixed telephony services should be provided as public and universalized services. It also established a universal service fund named the Fund for the Universalization of Telecommunication Services (FUST).

In Brazil, there are currently three main kinds of broadband services provided by the network operators: fixed broadband, mobile broadband, and satellite-based wireless systems. The five largest fixed broadband providers are state-owned Telebras, Oi, NET Servicos, Telefonica Brazil, and GVT. While computers are widely used to access broadband, smartphones are currently the dominant broadband access devices in Brazil

(Jensen, 2011). The mobile broadband operators provided access reaching 55.1% of the total 5,565 municipalities and 86.8% of the population by 2012.[6]

In an example of government collaboration, under Brazil's General Concessions Plan (PGO) telecommunications operators were required to allocate 1% of their revenues towards the Fund for Universalization of Telecommunication Services (FUST) (Albernaz, 2002). The funds raised were used to provide public telecommunication services, which were restricted to fixed telephony since other telecommunication services like broadband were not part of universalization goals at that time (Cunha, 2012; Jensen, 2011). Additionally, Brazil tried to promote broadband competition by compelling the large operators to share network infrastructure with smaller ones, and provide tax exemptions for broadband building.

Another example of collaboration between agencies and NGOs for public access to telecommunication is the implementation of public computing centers, or telecenters. The major digital inclusion strategies implemented by the Brazilian Federal Government, along with other government units and NGOs, are provisions of public access facilities -- telecenters. Around 8,000 telecenters offered free public access to computers and the Internet in more than 2,875 municipalities in 2005. Users access web pages, complete schoolwork and use the computers for entertainment. The centers also provide various kinds of free digital literacy classes. The major telecenter programs include Gesac, established by Brazil's Ministry of Communications, offering free satellite links to public

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6 The mobile broadband access is defined here as the sum of WCDMA and broadband terminals. http://www.teleco.com.br/3g_cobertura.asp

institutions in general and serving a total of 3,665 centers in 2005, and CDI, which had more than 891 telecenters.[7]

In a 2007 case study of São Paulo, Brazil by Madon, Reinhard, Roode and Walsham, the authors described three types of telecenters: community telecenters, government telecenters, and special purpose telecenters. Community telecenters, installed by government agencies and run by communities, are located in neighborhood community centers. The centers provided IT courses for users, many of whom are teenagers. Government telecenters are located in government buildings and public service centers, aiming at providing content and services relevant to the community and government. Special purpose telecenters initiated by government or NGOs are located in public institutions, such as schools, or NGO offices. Their goal is to promote social inclusion of the less-advantaged in society with digital literacy courses.

Privately run Internet cafés known as LAN Houses are a good example of private collaboration for public telecenters. The businesses play an important role in providing access to computers and the Internet and in promoting digital inclusion in Brazil, especially to people of lower socio-economic status (Jensen, 2011; Lemos & Martini, 2010). Vistors typically use the LAN houses for gaming, but the centers are also utilized for other tasks such as job assistance services. Lemos and Martini (2011) claimed that the government should either consider the partnership between LAN houses and public institutions or leave it alone to promote digital inclusion in its own way.

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7 http://www.spotlightonbrazil.com/2011/09/14/digital-inclusion-in-brazil-the-cdi/

In contrast to Brazil's highly concentrated urban areas, the vast rural regions have low population density and cannot attract deployment of fixed broadband infrastructure. Private operators only want to invest in densely populated areas, where people are likely to have higher socio-economic status and be able to afford broadband services (Jensen, 2011).

According to Warschauer (2003), telecommunications infrastructure and affordability are the two main problems holding back the development of broadband access in developing economies like Brazil. Brazil's challenge to closing the digital divide lies in the wide disparities of broadband access, which correspond to broad variations in income and wealth distribution.[8] In the lower socioeconomic levels and rural areas, fixed broadband reaches less than 1.5% of the population. Moreover, Brazil's geography presents a considerable challenge to the proliferation of telecommunication infrastructure, due to Brazil's low population density in rural areas where the penetration rate is lowest.[9]

Additionally, the regulatory framework still focuses on the universalization of telephony rather than new technologies, which prevents using the universal service fund to improve broadband penetration. Both the broadband services rates and investments required for building and upgrading infrastructure are very high (Cunha, 2012). Due to this, mobile access is becoming more popular among Brazilians, especially within low-income households, who benefit from competition between mobile providers. Fixed

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[8] See http://broadbandtoolkit.org/en/home
[9] See http://broadbandtoolkit.org/en/home

Internet competition is low, and fixed line penetration has been falling as it is replaced by wireless mobile subscriptions.[10]

There are other challenges to the achievement of digital inclusion objectives in Brazil (Jensen, 2011). The R$35 per month rate is still too high to be affordable to the poorest Brazilians. Telebras limits the download traffic to 300 megabytes per month for fixed broadband, which dissuades providers from using Telebras networks to provide service for their clients. Additionally, Brazil's PBNL does not focus on solutions to reduce the digital literacy gap, which has been compounded by citizens' lack of access to devices and the high-speed Internet, even though the organization claims that the government will try to build 100,000 telecenters by 2014.

Chile

In 2009, roughly 23% of households in Chile had broadband access at home, placing the country well behind a number of more developed countries in other parts of the world, including the United States, the United Kingdom, and Korea, where 68.2%, 69.5 % and 97.5% of the population, respectively, had broadband access.[11] However, access to and use of the Internet in Chile has grown significantly over the past few years (Agostini & Willington, 2012). For example, from December 2010 to December 2011, Chile experienced a 12.6% rise in Internet broadband penetration.[12] In addition, Chile has one of the highest rates of broadband penetration of countries in its region. Only Mexico, Argentina, and Brazil have comparable penetration levels. Nevertheless, a large

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[10] See http://broadbandtoolkit.org/en/home
[11] See http://www.oecd.org/Internet/broadbandandtelecom/oecdbroadbandportal.htm
[12] See http://www.oecd.org/Internet/broadbandandtelecom/oecdbroadbandportal.htm

digital divide still exists between those that have access and those that do not. Although the gap has been reduced in the past few years, the Chilean government is still working to increase broadband access to underserved communities through a number of policy initiatives.

In 2009, the Chilean government launched a major broadband accessibility initiative called the Enlaces Network, a long-term project that improved broadband infrastructure and connectivity. It also provided training for teachers and students across the country. In addition to improving accessibility in rural, low-density areas, the program sought to remedy the growing digital divide between rural and urban students (Salinas et al., 2009). Although less successful at developing and implementing effective technology-focused teacher training in rural schools, the project improved infrastructure, providing Internet access to 75% of Chilean students from subsidized schools in urban and rural areas.

Despite geographic challenges to infrastructure expansion, the Chilean government has made significant progress is providing access to low-income and rural segments of their population. In late 2008, under the leadership of President Michelle Bachelet, the country subsidized the Digital Infrastructure for Competition and Innovation project, providing funding to telecommunications companies willing to provide access to over three million people in remote areas. As the project develops, just under half of the targeted areas currently have access to broadband Internet, and this proportion is rising.

Along with a focus on rural infrastructure expansion, Chile has also sought to offer free Internet access through its public library and "laboratory" system. These facilities are located in more densely populated regions and are open to the public during normal business hours. Although not all facilities offer Wi-Fi, they do have free Internet connections through landlines inside the buildings. Also, when computers are not present for public use, Wi-Fi can normally be found.

The primary reasons for the lack of broadband access and usage in Chile are related to economic factors associated with the cost of access and technology. According to a 2010 study of households in Chile, 23% of respondents said their main reason for lacking broadband access at home was that they did not have a computer, and 48% said they did not have a computer because of the high cost (Agostini & Willington, 2012). Another 22% of people said the main reason they did not have broadband access was the high cost of a monthly broadband plan. Other reasons for not having access included lack of knowledge of the Internet and its general utility, and lack of interest in the services offered.

Overall, the percentage of Internet usage reported by heads of households in Chile was highest among males, at 54%, and those who had completed some secondary education, at 86%. The lowest reported usage rate was among heads of households with lower levels of education, with those who had not completed primary school reporting a usage rate of only 12%.

India

India has found itself near the forefront of an "Information Technology (IT) revolution" over the last decade and a half. The growth of the IT sector helped spur a period of tremendous economic growth in the early 21st century, growth which has made India the world's second fastest growing economy, behind China. Currently, India's connectivity rates are lower than those of Brazil, Russia, and China, countries which are in a similar state of economic development.[13] Academics and government officials seem to agree on the importance of changing this. As one leading Indian economic research firm put it, "[It] will be recreation and communication that will drive household expenditures the most."[14] The Telecom Regulatory Authority of India (TRAI) is tasked with oversight of the country's policy towards ICTs. Creating and nurturing the growth of telecommunications has been one of TRAI's primary missions. Some of this accelerated growth is promoted at the state level, as Indian states have their own ICT policies.

In India, for-profit ventures have commonly worked alongside the government to create solutions for expanding broadband access. Particularly in urban areas, public computing has taken the form of coffee shops run by entrepreneurs, with less involvement from local government (Kuriyan & Ray, 2009).

India's approach towards public computing has evolved over the last decade. In the early 2000s,"hole-in-the-wall" kiosks were somewhat common in rural communities, which were typically composed of publicly-accessible outdoor computer terminals built into an actual wall or other solid structure. Many of these kiosks fell out of repair later in

[13] See http://maplecroft.com/about/news/digital_inclusion_index.html
[14] See http://www.scribd.com/doc/24981444/India-2020

the decade, some having been left with no operators to tend to their upkeep, and others in need of maintenance or repair that operators could not provide.[15]

Currently, the trend in rural areas is towards establishing computing kiosks in "gram panchayats," India's equivalent of American town halls or local government centers. Many of these kiosks consist of a single computer terminal staffed by an operator who can conduct searches or complete other basic computing tasks for rural villagers who might not be able to accomplish them. As a sign of how the kiosks are working to bridge the digital divide, Indian farmers use these computing centers to access information about fair market prices for goods. Providing this kind of access can lead to more perfect information and a fairer economy for all, whereas a lack of access to technology may put other Indians at an economic disadvantage.[16]

In more urban areas, public computing usually comes in the form of coffee shops run by entrepreneurs, and local governments are less involved. The gender of kiosk customers tends to mirror the gender of the operator, with 70% of kiosk customers relying on the operator to help them use the computing terminals. Kiosk users tend to be young, with 30% between the ages of 19 and 25 and another 35% between 26 and 35.

Unlike the urban Internet cafes that provide only Internet access, rural kiosks offer a wider range of services that are customized for rural users. These services include access and assistance for e-government applications, computer literacy programs, and English speaking classes. The kind of users that frequented these kiosks tended to be relatively young, with 65% of the users ranging from 19 to 35 years of age. Interestingly,

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[15] See http://www.scribd.com/doc/24981444/India-2020

[16] See Internethttp://www.bbc.co.uk/news/business-13414762

their research found that customer demographics closely mirrored those of the kiosk operator in terms of gender. Overwhelmingly, women visited kiosks that were owned and operated by other women.

Word of mouth marketing was found to be the primary driver of business for rural kiosks and almost 70% of the users reported that they visited the kiosks after learning about them through family members or friends. However, once inside the kiosks, clients said that they barely used the machines on their own. The kiosk operator emerged as a major intermediary between the clients and their computer use. Seventy percent of clients reported that the kiosk operator handled almost all the computer and Internet transactions, so that the clients barely had a chance to work on the computer themselves.

Rural kiosks are undeniably relevant to users. Kiosks are used for learning computer skills; entertainment purposes such as games, music, and movies; e-government applications; desktop publishing; services to support agriculture; language classes; and other income-generating services such as providing printing and photocopier services. Early evidence indicates that these kiosks help villagers improve their economic standard of living by expanding livelihood options and empowering them with information, tools, goods, and services such as education and healthcare (Toyama et al., 2005). Yet for all their utility, the economic viability and long-term sustainability of the kiosks poses a considerable challenge for the continued existence of the rural computer centers. This observation also calls attention to the business model of public computing initiatives in India. Historically, ICT initiatives have attracted a public-private partnership in India (Kuriyan & Ray, 2009). Additionally, each state in India adopts its own policies and sets

its own pace in implementing them. Kuriyan and Ray (2009) found that though the state partners with private agencies, these private actors are themselves ordinary citizens with modest means. Thus, the state remains a key player in the privatization of ICT initiatives and retains considerable control over its execution.

India is one of the fastest growing broadband markets in the world, but its fixed broadband penetration rate is still only about 1% of India's population.[17] Internet penetration across the entire Indian population is at 10%, and only 3% in rural populations, yet India has the second highest number of Facebook users (Canton, 2012). A challenge for India in closing the digital divide is lowering the cost of access. Wealthier Indians based in urban areas have embraced modern communications technology, and the growing middle class, about 30% of the country, have driven demand for consumer goods like PCs and laptops. However, the majority of the remaining population has been left out of the push for ICT and Internet access.[18] Only 3% of households in India own a PC, and the majority of the population does not have the education needed to use the technology effectively, especially in rural areas with little connectivity and Internet penetration.[19]

South Korea

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17 Chakraborty, S., Jain, G., & Gupta, A. (2012, September 28). Broadband ecosystem for inclusive growth. *CII Broadband Summit, New Delhi*. Retrieved April 2, 2013, from http://www.kpmg.com/IN/en/IssuesAndInsights/ThoughtLeadership/Broadband-Summit-12.pdf

18 See http://maplecroft.com/about/news/digital_inclusion_index.html

19 See http://maplecroft.com/about/news/digital_inclusion_index.html

South Korea's intense focus established the nation as a world leader in information and communication technology. In 2011, the ITU reported nearly 84% of the Korean population used the Internet, and the nation boasted over 36 fixed broadband subscriptions per 100 inhabitants.[20] According to data from the Organization for Economic Cooperation and Development (OECD), South Korea was the first country to surpass 100% penetration for wireless broadband (Osborne, 2012). This was due in large part to the expansion of smartphone use and the Korean population's use of multiple technological outlets.[21] South Korea has adopted a holistic approach that incorporates active government involvement to create an information society. This includes the creation of five-year "ICT Master Plans" beginning in 1962. The combination of broadband infrastructure and demand promotion initiatives differentiates Korea's approach to broadband accessibility. Creating a national information technology (IT) skill set began in 1984 with the formation of the Information Technology Training Center (ITTC). This organization would evolve through several incarnations in its mission of providing IT education, serving ten million South Koreans by 2000. That same year South Korea pioneered broadband Internet services with the introduction of IT World, a high-speed ICT experience center, which was essential exposure for fostering demand. The Korean Agency for Digital Opportunity and Promotion (KADO) subsumed these roles upon its creation in 2003, becoming the lead organization for knowledge and information resource management in 2005. KADO was responsible for establishing

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20 See http://www.itu.int/ITU-D/ict/statistics/

21 Moran, Andrew, OECD to Examiner newsgroup, "South Korea Surpasses 100% in OECD Report of High-Speed Internet Penetration," July 23, 2012.. Available at: http://www.examiner.com/article/south-korea-surpasses-100-oecd-report-of-high-speed-Internet-penetration; Last accessed 11/5/12

accessibility guidelines to encourage traditionally excluded groups to go online.[22] This offline population includes people with disabilities, the elderly, rural residents, low-income families, stay-at-home wives, military personnel, and even prison inmates.

Additionally, the importance placed on ICT education and South Korean student academic success was a significant factor in the economic growth of the technology industry. This process included the establishment of the Committee for the Promotion of Information; a Department of Educational Information within the Ministry of Education; and the formation of the Korea Education & Research Information Service (KERIS) to provide oversight of educational information research.

Korea is currently looking at steps beyond broadband; nationwide expansion of very high-speed networks, capable of one gigabit per second over wired connections, and at least 10 megabits per second wirelessly, dubbed the 'Broadcast Communication Convergence Network' (BcN). Mirroring policies to promote broadband penetration, expanding BcN penetration relies on infrastructure expansion and user demand. Generating demand relies on enhancing user accessibility and developing specialized services.

South Korea's high urbanization and population density have facilitated its broadband expansion. The National Computerization Agency was founded in 1987 to coordinate the construction of information network infrastructure. This agency also went through several evolutions in its task of building the 'Korea Information Infrastructure,' eventually becoming the National Information Society Agency (NIA). This organization

[22] See http://eng.nia.or.kr/english/Contents/01_about/history.asp?BoardID=20111223115026806 1&Order=105

supported the development of specialized technologies for national informatization, pioneered Korean e-government technology, and built administrative information databases to enhance Korea's digital competitiveness.[23]

While the government spent $24 billion on a national high-speed network, the NIA has also fostered competition in the private sector to improve broadband penetration. This was accomplished with low-interest loans for companies that built their own networks and competed with the nation's dominant carrier, Korea Telecom. These loans encouraged network construction in rural areas. The Korean government also pushed Korea Telecom to expand rural service by making it a condition of its transition from state-owned monopoly to private enterprise (Borland & Kanellos, 2004).

Open networks are another feature of Korea's broadband expansion. This concept forces the incumbent broadband provider to share their network infrastructure with newcomers. Thus, Hanaro Telecom[24] has become the second-largest broadband provider in part by utilizing Korea Telecom's cable lines. Hanaro has also established its own fiber network, offering many apartment buildings a choice in their service provider (Borland & Kanellos, 2004). A plurality of service providers produces vigorous competition, and consumers therefore benefit from high speeds and low prices.

Korea's broadband network expansion is largely accomplished, with large office and apartment buildings receiving fiber connections by 1997. Nearly a third of households had broadband digital subscriber lines (DSL) or cable connections by 2000.

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[23] See http://eng.nia.or.kr/english/Contents/01_about/history.asp?BoardID=20111223115026806 1&Order=105;

[24] In 2008, Hanaro Telecom changed its name to SK Broadband.

While less than 1% of South Koreans used the Internet in 1995, more than 71% of households were broadband subscribers by 2004 (Borland & Kanellos, 2004). From 2003 to 2007, rural Internet usage more than doubled, from 16.2% to 33.4% of residents. Since 1997, KADO collected over 160,000 used personal computers (PCs) from offices and schools, and refurbished and distributed them to low-income families for free (Woyke, 2009). As a result, rural PC ownership climbed to 55% from 33.2% between 2003 and 2007 (Woyke, 2009).

Korean experience shows that providing access through infrastructure expansion is a critical first step in establishing user demand for high-speed services. The high speeds offered by broadband were essential for creating new 'killer apps,' features or applications of new technology presented as indispensable or far superior to rivals. Killer apps are significant drivers of demand, and online gaming powered by high-speed networks is a killer app in South Korea. The Korean gaming industry is valued at over $2.5 billion and involves over half of the nation, with 30 million users (McCurry, 2010). Video game competitions are attended by tens of thousands, multiple television stations are dedicated to game coverage, and video game players known as 'e-sports athletes' are treated as celebrities, with top players attracted from around the world by salaries approaching $300,000 a year (McCurry, 2010).

It is commonly said that most South Korean gamers prefer to play in Internet cafes known as PC bangs instead of at home. Stewart and Choi (2003) argued that the socializing environment embedded in Korean culture led to the popularity of PC bangs and other "Bangs" such as the manwhabang (comic reading room) and norebang (singing

room). Around 22,000 PC bangs offer Koreans all over the country access to high-speed connections and the latest PC hardware for low hourly rates. The explosion in PC bang growth is highly correlated with the popularity of online gaming in Korea.[25]

A significant portion of Korea's offline population includes people with disabilities. KADO has focused on creating universal standards for web sites, software, and cellphone keypads to enhance the accessibility for users with special needs. KADO also provides communication services for users with hearing or speech impairments. The organization even subsidizes up to 80% of the cost of developing assistive devices. KADO has also offered online and offline public IT courses in urban areas while partnering with civic governments and associations to provide education and access to remote areas. Utilizing volunteer teachers, the outreach includes classes in private homes. Foreigners with Korean spouses are offered online language courses, literacy services are provided, and even the 10,000 North Korean refugees currently in South Korea are offered specialized IT training (Woyke, 2009).

United Kingdom

The United Kingdom ranks fifth worldwide in number of IP addresses, with roughly 26 million.[26] Ofcom, the UK communications regulator, reports the majority of homes are now connected to the Internet, up from 25% in 2000 to 76% in 2011. However, broadband usage varies geographically, with just 61% of Scottish homes

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25 McCurry; Boreand and Kanellos

26 See http://www.akamai.com/dl/whitepapers/akamai_soti_q212.pdf?curl=/dl/whitepapers/akamai_soti_q212.pdf&solcheck=1&WT.mc_id=soti_Q212&

having broadband access compared to 71% in Wales and 75% in Northern Ireland. The UK government launched the Digital Champion program in 2010 (part of the European Union initiative by the same name), appointing former start-up entrepreneur Martha Lane Fox to lead an initiative that would encourage national online participation and reduce the online-offline access gap.

The primary strategy of the program has been to forge key partnerships between major corporations, the media industry, and relevant government organizations. Successes have been defined in the following terms: 1) Making concrete challenges to organizations through manifestos, and pressuring them to publicly pledge support, 2) aligning partner objectives and mediating interests to avoid potential conflicts, and 3) facilitating coordination through national digital conferences. Online pledges offer accountability, ensuring quick and relevant action among supporters. The use of a manifesto has given corporations more incentive to participate because they can show customers and investors material evidence of how they are giving back to the community.

As UK Digital Champion, Lane Fox has pressured organizations to embed the pledges into their corporate mission and investment plans. For example, she and her backers worked with Microsoft to create a £95 computer for underserved populations. The computers are refurbished, but are fully functional and come with the essential software pre-installed. In addition to generating awareness about the issue of digital exclusion, public pressure makes the commitments more binding while motivating other corporations to adopt the pledges.

The strong alliances Lane Fox and her team have made with key media industry partners are crucial to the program's success. Through partnerships with print, broadcast, and online media, the program has received £24 million worth of press coverage. The BBC was a particularly strong partner, generating significant public attention to the "Go ON UK" digital literacy campaign. The team also published a "Case Book" report that contains numerous examples illustrating the benefits of online participation, which gained popularity through promotion from media partners.

Lastly, the Digital Champion team partnered with government organizations and pushed them to commit to their online pledges. These partnerships strongly encourage the "Digital by Default" strategy for eliminating digital exclusion and reducing government costs. The agenda calls for moving the application and distribution process for all government services online, thus forcing non-Internet users to adopt some minimum degree of online usage.

In July 2012 the House of Lords Communications Committee published *Broadband for All—An Alternative Vision, which* suggested that the government is actually neglecting to treat the common network—the core of the UK broadband infrastructure—as a strategic, national asset.[27] It suggests a goal of increasing the national penetration of superfast broadband (24Mbps) to 90% by 2015, with a guarantee that the remaining 10% of the nation have minimum broadband access (2Mbps).

Other key recommendations include open access to the network for everyone, government regulation, and public emphasis on, as well as allocation of resources to,

[27] See *http://www.publications.parliament.uk/pa/ld201213/ldselect/ldcomuni/41/4102.htm*.
[27]

enlarging the "middle mile"—a subsidized span of the Internet infrastructure that extends from the core network—into more remote areas of the nation. This would in turn shrink the size of local access networks and reduce the related expenses to those localities and individuals who would otherwise have to fund the infrastructure extension. In this way, the Lords Committee advocates reducing the burden on households—particularly those in rural areas--by increasing the geographic range of government-supported Internet infrastructure.

The report also identifies mobile networks as an important component of broadband access. New and future infrastructure, the authors argue, will need to focus on wireless service in addition to building on the existing copper and fiber wireline network, addressing the increasing demand for mobile access. Mobile broadband can supplement the current physical infrastructure, which will require continued investment in core network lines.

Underlying and supporting the Digital Champion program goals at the national and local levels is a publicly funded network of Internet centers—the UK Online Centers and People's Network of Public Libraries. The network of UK Online Centers consists of a sizable network of 3,800 community-based Internet centers. In the early 2000s, the People's Network of Public Libraries began rolling out a system of 30,000 Internet-enabled PCs, 90% of which provided free public Internet access, in public libraries. In addition, the UK Department for Work and Pensions funds 820 "Jobcentre Plus Offices" to assist non-Internet users in preparing online applications and resumes.

In addition to the national Digital Champion efforts, UK Digital Centers, and the government's potential funding of local broadband infrastructure, a particularly innovative local initiative has seen success in connecting some remote areas of the Scottish Highlands by connecting those populations that are currently lacking service or are underserviced.

Scotland has a relatively low Internet adoption, with 76% of households having Internet access. To address the national access problem, which is the result of local physical and social factors, and particularly a product of the remote location of homes in the rugged and undeveloped Scottish highlands, a broadband research initiative has made interesting progress. The collaboration over the past several years between High-Speed Universal Broadband for Scotland (HUBS)[28] and Tegola[29] has led to the development of a local distributed network that connects several contiguous Scottish Highlands communities.

Notable amongst these is Knoydart, a scenic but topographically remote and rugged—both in terms of mountainous and water-bound terrain and sparsely populated peninsula of 55,000 acres. The bulk of this land is unsettled, with about half of the two hundred inhabitants living in one main settlement. Most of Knoydart is privately owned

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[28] HUBS is a joint enterprise between the University of the Highlands and Islands, the University of Edinburgh and the University of Stirling, which aims to "assist with the provision of high speed Internet access to communities in rural areas in Scotland that would otherwise be unserviced."
[28]"Tegola and HUBS: Community Broadband Infrastructure in Scotland." The Tegola Project, 23 Sept. 2012. Web. 05 Nov. 2012. http://www.tegola.org.uk/.
[29] The Tegola Project is a research project led by Peter Buneman of University of Edinburgh's School of Informatics, "for research into the delivery of low-cost, reliable and high speed broadband in rural areas."
[29]Tegola and HUBS

by conservation and farming trusts and estates.[30] The Tegola/HUBS enterprise has succeeded in Knoydart and elsewhere in developing physical infrastructure models that can support high-speed and high-quality broadband and can be built and maintained by communities. By bringing support and technical expertise to local community networks, researchers have taught local populations both the skills and the social, cultural, and entrepreneurial benefits the Internet brings (Cellan-Jones, 2012). Tegola/HUBS has also been pivotal in helping communities that are too small to negotiate with telecommunications providers on their own by representing them in aggregate. And, in cases where a community is interested in calling on Tegola research and infrastructure models, information is freely accessible.

More than 16 million people over the age of 15 still lack basic online skills in the United Kingdom. "Just 33% of small to medium-sized companies have a digital presence and only 14% sell their products online. Charities are among the organizations with the most to gain from upping their digital skills, yet one-fifth have little or no web presence and 50% need help with web design and social media."[31] Moreover, while official government reports acknowledge poor broadband availability in rural areas, particularly in Scotland and Wales, obstacles to urban broadband adoption are still significant.[32] Rural percentages of broadband connections may lag significantly behind urban

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[30] See http://www.knoydart-foundation.com/home/about-knoydart/.
[31] See http://www.go-on.co.uk/challenge/uk-snapshot
[32] See http://d2a9983j4okwzn.cloudfront.net/downloads/ofcom-uk-broadband-speed-report-2011.pdf

broadband rates, but the absolute magnitude of the users without broadband access is higher in urban areas, particularly in London.[33]

[33] See http://regeneris.wordpress.com/2011/07/08/uk-broadband-challenge/

	Year of Latest Data	Home Computer	Internet Access at Home
Argentina	2011	51	41
Brazil	2011	45.4	37.8
Chile	2011	50.5	41
India	2011	9.5	N/A
Korea (Rep.)	2012	82.3	97.4
UK	2012	87	83*
US	2011	75.6	71.7**

Table 1: Access to Computers and the Internet by Household
Source: ITU Data
*Data is from 2011
**United States Census Bureau

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
U.K.	33.48	56.48	64.82	65.61	70.00	68.82	75.09	78.39	83.56	85.00	86.84	87.02
Argentina	9.78	10.88	11.91	16.04	17.72	20.93	25.95	28.11	34.00	45.00	51.00	55.80
Brazil	4.53	9.15	13.21	19.07	21.02	28.18	30.88	33.83	39.22	40.65	45.00	49.85
Chile	19.10	22.10	25.47	28.18	31.18	34.50	35.90	37.30	41.56	45.00	52.25	61.42
India	0.66	1.54	1.69	1.98	2.39	2.81	3.95	4.38	5.12	7.50	10.07	12.58
Korea (Rep.)	56.60	59.40	65.50	72.70	73.50	78.10	78.80	81.00	81.60	83.70	83.80	84.10

Table 2: Percentage of Individuals Using the Internet
Source: ITU Data. Percentages for 2012 are estimates.

Chapter 3: Digital Inclusion in Texas

This chapter situates our study of Texas Connects Coalition, Austin Free-Net, and Technology for All in regard to past, recent, and ongoing computer and Internet access initiatives. We also discuss the Broadband Technology Opportunities Program (BTOP)'s sponsorship of Technology for All and note related BTOP projects and studies.

The chapter briefly describes the context from which we approach our study of the Texas Connects Coalition and public computer center sites, beginning with an summary of the history of the Internet, which was government-sponsored from the beginning. We then introduce public access support as a function of high-level infrastructure initiatives and local community access points and networks, as described in relevant scholarly literature.

We describe the contemporary public access landscape in Texas, beginning with an overview of the Broadband Technology Opportunities Program (BTOP) in Texas before providing a survey of relevant studies. The chapter discusses the Texas Connects Coalition including Austin Free-Net and Technology for All, and looks at Texas public libraries. We also describe BTOP's Texas sustainable broadband adoption grantee, Connected Texas, an organization that focuses on building Texas broadband infrastructure.

Historical Overview

Most histories that chronicle public initiatives to support access to the Internet begin by addressing when computing and the Internet became relevant to the American public. The United States government initiated the development of the Internet and supported its early steps. The government's first active support of public access to the Internet began with the 1996 Telecommunications Act and its e-rate provisions, introduced in 1997 under the direction of the FCC. This subsidy from the Universal Service Fund still supports library and school access and adoption, subject to certain regulations including content restrictions.

The state of Texas was also an early supporter of public Internet access, initiating the Telecommunications Infrastructure Fund, or TIF, in 1996. TIF drew on a tax that telecommunications firms shifted to their customers, and funded Internet infrastructure including the physical network of the Internet needed for community computer access (Strover, Waters, & Chapman, 2004). The fund and its activities expired in 2005 as part of a shift away from government "interference" with telecommunications in Texas (Sunset Advisory Commission, 2004). Austin Free-Net and Technology for All bookended the E-Rate and TIF initiatives with Austin Free-Net. founded in 1995, and Technology for All, created in 1997. The organizations began as community technology or computer centers and networks, and since their founding have supported computer and Internet access and provided online resources for underserved communities.

Bridging the Digital Divide

In *Bridging the Digital Divide*, Servon (2002) chronicles the early history of community technology centers (CTCs), which are the organizations that most resemble

our contemporary public computer centers (PCCs). Servon's (2002) history is situated in her larger discussion of the United States community technology movement and its "potential…to enable progress on the entrenched problems of inequality and persistent poverty" (p. 233). As Servon's (2002) research attempted more specifically to address problems of the digital divide in relation to public policy, including urban poverty policy, and local government initiatives and innovations, she first focused on community technology developments in the cities of Austin, Pittsburgh, and Seattle. Her work addresses "the relationship between education and technology, between workforce development and IT, and the potential synergies between the community technology movement and the community-building movement" (Servon, 2002, p. 243). Although now ten years old, her research remains relevant today as the digital divide persists despite community, local government, and broader policy initiatives that aim to quash it.

Particularly relevant to our study, Servon's (2002) work includes an overview of the State of Texas's early initiatives and Austin Free-Net's founding and development. Texas was an early and strong supporter of digital inclusion, deploying the Texas Education Network (TENET) in 1990 to bring Texas teachers online, and initiating TIF in 1996 to "help Texas deploy an advanced telecommunications infrastructure by promoting connectivity for public schools, higher education, public libraries, and nonprofit healthcare facilities" (Servon, 2002, p. 97). For TENET and TIF as well as the national E-Rate program, support of education and technology went hand-in-hand.

Founded in 1995, Austin Free-Net supported a community and an electronic network from the beginning. Servon (2002) defines the distinction: "Although

community networks focus on the electronic connections between people who share place-based community, centers focus more on the creation of places in which community members can learn about and use technology" (p. 51). Austin Free-Net began as a network "but always incorporated an emphasis on the siting of public access terminals" (Servon, 2002, p. 52). She observes that increasingly, the network-public access site distinction has blurred.

Servon (2002)'s *Bridging the Digital Divide* concludes with a discussion of the development of community technology initiatives, including centers and networks, as having "grown up at the edges of established institutional arrangements, in the interstices between traditional spheres and existing community-based movements" (p. 221). While community technology centers cannot bridge the digital divide on their own, she suggests they may narrow it and point the way for bigger policy initiatives.

Beyond Community Networking and CTCs: Access, Development, and Public Policy

Research by Strover, Chapman, & Waters (2004) evaluated thirty-six Texas communities' efforts to establish community technology networks and centers. The study focused on evaluating "the efforts of those towns and cities in order to assess how communities organized themselves to establish community networks" (Strover et al., 2004, p. 468). This study collected quantitative and qualitative data about community public access objectives, practices, and outcomes of the funded projects in relation to TIF funding.

The study found public access to have expanded as a result of the TIF grant, but access varied across communities in terms of quality and consistency. For example, while computers that were integrated into the work and needs of particular communities at particular access points were largely well used, "computers that were 'dropped in' to locations where they were unexpected or inconsistent with the other activities and services offered were not well utilized" (Strover et al., 2004, p. 477). The study also observed that both computers and assistance were essential: "Complementing the effect of good technical support, good *technology* was also fundamental" (Strover et al., 2004, p. 480). The authors describe the multi-layered challenges that faced community efforts, discussing the diversity of publics served by access centers and different interpretations of success. In conclusion, they suggested: "Defining the public to be reached, and defining the public spaces they inhabit proved to be difficult for many of the projects, especially in the face of the not-so-simple tasks of maintaining fussy computers and ensuring someone would be available to help users" (Strover et al., 2004, p. 482).

Public Access Today

As described above, the State of Texas played an early role in encouraging infrastructural support of, and community development around computing and the Internet. Today actors across the state continue to participate in digital inclusion work. Both the State Libraries system and larger cities have maintained roles providing public access and training in various ways. Supporting local nonprofits such as Austin Free-Net continues to be a useful mechanism for remediating the digital divide. .

Broadband Technology Opportunities Program (BTOP)[34]

The American Recovery and Reinvestment Act of 2009 (ARRA) provided the Department of Commerce's National Telecommunications and Information Agency (NTIA) and the United States Department of Agriculture's Rural Utilities Services (RUS) with $7.2 billion to expand access to broadband services in the United States. Of those funds, NTIA received $4.7 billion to support the deployment of broadband infrastructure, encourage sustainable broadband adoption and maintain a public national map of broadband service capability and availability, and enhance public computer centers through the Broadband Technology Opportunities Program (BTOP). BTOP funds more than 230 projects, providing training and support to anchor institutions.

BTOP's Three Funding Categories

Comprehensive Community Infrastructure

These are projects to deploy new or improved broadband Internet facilities (e.g., laying new fiber-optic cables or upgrading wireless towers) and to connect community anchor institutions, such as schools, libraries, hospitals, and public safety facilities.

Public Computer Centers

These are projects to establish new public computer facilities or upgrade existing ones that provide broadband access to the general public or to specific vulnerable

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[34] See http://www2.ntia.doc.gov/about

populations, such as low-income individuals, the unemployed, seniors, children, minorities, and people with disabilities (http://www2.ntia.doc.gov/about).

Sustainable Broadband Adoption

These are projects that focus on increasing broadband Internet usage and adoption, including among vulnerable populations where broadband technology traditionally has been underutilized (http://www2.ntia.doc.gov/about).

State Broadband Data and Development

NTIA's State Broadband Data and Development (SBDD) program aims to facilitate the integration of broadband technology into both state and local economies. The program recognizes that broadband technology will not unleash the advantages of broadband alone. To be successful, BTOP must depend on the knowledge of local stakeholders to assist patrons to help leverage the technology.

Since the beginning of the SBDD initiative, NTIA has awarded over $300 million to 56 grantees (e.g. state agencies, nonprofits) from every state, five territories, and the District of Columbia (http://www2.ntia.doc.gov/about).

The rate of home broadband adoption is slowing. In 2009, about 63% of U.S. homes subscribed to a wireline broadband service, and in 2010 the number had only risen three percentage points, to 66%. Three years later, the Pew Internet and American Life Project reports that 70% of adults have broadband at home (http://pewinternet.org/Reports/2013/Broadband.aspx). Although rates of broadband

adoption have risen a great deal over the past ten years (Whitacre et al., 2013), that rate may be slowing now that the regions that were easiest to reach are covered and now that a high percentage of the populations most interested in having access and able to afford it have been satisfied.

BTOP's Impact on Libraries

BTOP has funded many state agencies and nonprofits, including library initiatives to upgrade computer equipment and broadband speeds. Despite the budgeting pressures libraries face, these staple American institutions have provided crucial public access to job search resources. According to a 2012 Public Library Funding and Technology Access Study funded by the American Library Association and the Bill & Melinda Gates Foundation, 76% of library patrons used the library's computer Internet access for their job search and 23% received job training at the library. Also according to that report:

- Public libraries reported an average of 16.4 computers in 2012. This is up from 14.2 computers two years earlier. Additionally, 65% of libraries reported insufficient public computers to meet demand. This is down from 76% the previous year.
- In 2012, 13% of libraries added or replaced computers with BTOP funds., and 12% plan to add or replace computers with BTOP funds for 2013.
- About one third of libraries reported offering connection speeds greater than 10 Mbps in 2012. This is up from 18% of libraries two years before. While 41% of libraries reported slow Internet connection speeds in 2010, this is four percentage points less than in 2011. (Hoffman, Berlot, & Davis, 2012).

BTOP in Texas

BTOP sent a total of $264,729,274 to a variety of organizations and initiatives across the state of Texas. This study looks at one of six public computer center organizations that together received $31,910,533 in BTOP funding. Technology for All received the largest of these awards, at $9,588,279, which represented almost 30% of BTOP funds allocated to Texas computer centers, and around three and a half percent of all Texas BTOP funds.

Other BTOP public computer center grantees included the cities of Brownsville and El Paso, the Texas State Library and Archives Commission, the Deaf Action Center of Louisiana—a provider of "Video Remote Interpretation," or interpretation for deaf citizens through video conferencing—and the Mission Economic Development Agency, and Technology for All. The sites focus on specific communities or needs, including Spanish language learning and community support (NTIA, 2013).

Grantee	Total Award
City of Brownsville	$865,920
City of El Paso	$8,395,752
Deaf Action Center of Louisiana	$1,380,513
Mission Economic Development Agency	$3,724,128
Technology for All, Inc.	$9,588,279
Texas State Library & Archives Commission	$7,955,941
Total	$31,910,533

Table 3: BTOP in Texas: Public Computer Centers
Note: Data from NTIA's BTOP program reports

If You Build It – Will They Come?

A growing number of studies have been conducted on the necessity and effectiveness of PCCs. Some have focused on particular dimensions, such as understanding users' information needs (Schejter & Martin, 2012), evaluating digital inclusion initiatives at the local level (Peacock, 2012), and analyzing the cost-effectiveness of funding distribution for PCCs (Jayakar & Park, 2012). For instance, Schejter and Martin (2012) examined users of three BTOP-funded PCCs in Pittsburgh, Pennsylvania to better understand the localized value of broadband Internet access for those who lack Internet access.

Schejter and Martin's (2012) analysis reinforces Servon's (2002) observations of the role of public or community technology support as just part of a solution. Each

community access point has a distinct character and caters to specific community information needs; no center's strategies can serve as a catchall answer for all digital inclusion issues. The digital divide, the authors conclude, does not describe a binary situation of haves and have-nots; instead "the 'digital divide' is more of a 'stratified digital difference' and attempting to define it as resolved by declaring a neighborhood or a person 'connected' is far from enough" (Schejter & Martin, 2012, p. 25).

Schejter and Martin (2012) also suggest a range of potential uses of information and communications technology: "[L]ow income users tend to use social networking sites, gaming, and online shopping as an entry point for online capacity building" (p. 25). Each user, however, got something unique out of his or her PCC experience. Pre-determining outcomes, the authors find, was not an effective or sufficient means of supporting meaningful and sustainable community connectivity.

ASR Analytics

NTIA commissioned an independent agency, ASR Analytics, LLC (ASR), to study and evaluate BTOP-funded projects over the course of four years. While ASR's review of the program is ongoing, an interim report issued in October 2012 provides an overview of work accomplished to that date by BTOP-funded public computer center (PCC) and sustainable broadband adoption (SBA) projects. While 65 PCC projects and 43 SBA projects were funded in total, the report focuses on 15 case studies, including eight case studies of public computer center projects and seven of sustainable broadband projects. Technology for All was included in the study; Connected Texas was not.

The ASR report begins by addressing the immediate economic context of the American Recovery and Reinvestment Act, which has its origins in the 2008 financial crisis and appropriated $4.7 billion to the National Telecommunications and Information Administration (NTIA) to be allocated through the Broadband Technology Opportunities Program (BTOP). BTOP supported building and growth of technology and information infrastructure to "spur job creation and stimulate economic growth and opportunity" (ASR, 2012, p. 1). The study has identified five areas of focus amongst the sites, which include workforce and economic development, education and training, healthcare, quality of life/civic engagement, and digital literacy. Most projects addressed more than one of these areas, and all grantees supported digital literacy.

The ASR report describes Texas Connects Coalition's support of public computer center access and education in diverse communities, and specifically describes Austin Free-Net's emphasis on employment-oriented training modules (ASR, 2012, p. 21). While ASR reported in 2012 that the coalition consisted of 70 sites, it has grown considerably in the past year.

Texas Connects Coalition

Texas Connects Coalition is a relatively young organization that was formed in 2009 by Austin Free-Net, Technology for All, and a smaller group of rural sites that is no longer maintained under separate leadership, Metropolitan Austin Interactive Network (MAIN). The coalition brings together the administration of public computer center sites in urban Texas including the cities of Austin, Houston, and San Antonio, and in central

and south central rural Texas. Today Texas Connects Coalition represents over ninety public computer center sites, coordinating resource allocation, funding, and reporting to funders. Technology for All is the fiscal manager for the coalition.

Texas Connects Coalition works to further community, state, and national-level objectives in supporting and providing stand-alone and integrated space for computers; equipment including hardware, like computers and printers; software such as the Microsoft Office Suite; broadband Internet access; technical support; and one-on-one or group training for clients. Relationships between the coalition and individual public computer sites vary according to individual site resources and missions, but their standard formal agreements, or memoranda of understanding (MOUs), all cover management of hardware and software equipment, training, publicity, and reporting about use and training in terms of user hours.

Texas Libraries

Like Austin Free-Net and Technology for All, Texas libraries have been consistent participants in digital inclusion work across the state. Like public computer centers, libraries are hybrid organizations that support both access to and dissemination of information; they may also share funding and sites.

The Texas State Library & Archives Commission (TSLAC), another grantee of the Broadband Technology Opportunities Program (BTOP) as described below, has put BTOP funds towards additions to and improvements of hardware, staff training, and a webinar and translation of a computer manual for Spanish-speaking Latino Texans through its Technology Expertise, Access and Learning for all Texans (TEAL) program.

TSLAC also provides additional support for mobile access-related projects at Texas libraries ("Mobile Solutions") and through competitive grants, which are awarded to libraries featuring special collections, those attempting to reach patrons with special needs, and others that need seed money for new and innovative programming. TSLAC also provides support and information for libraries seeking E-Rate discounts (TSLAC, 2013).

Texas public library initiatives at the local level have also evolved with technology and the degree of Internet access demanded by patrons. They were amongst the first public Internet access points and have been supported by state and federal government since the 1990s, in terms of infrastructural support through the E-Rate and TIF programs, and state library initiatives like TEAL. A number of independent agencies like the Texas Book Festival and the Gates Foundation also support technology in libraries.

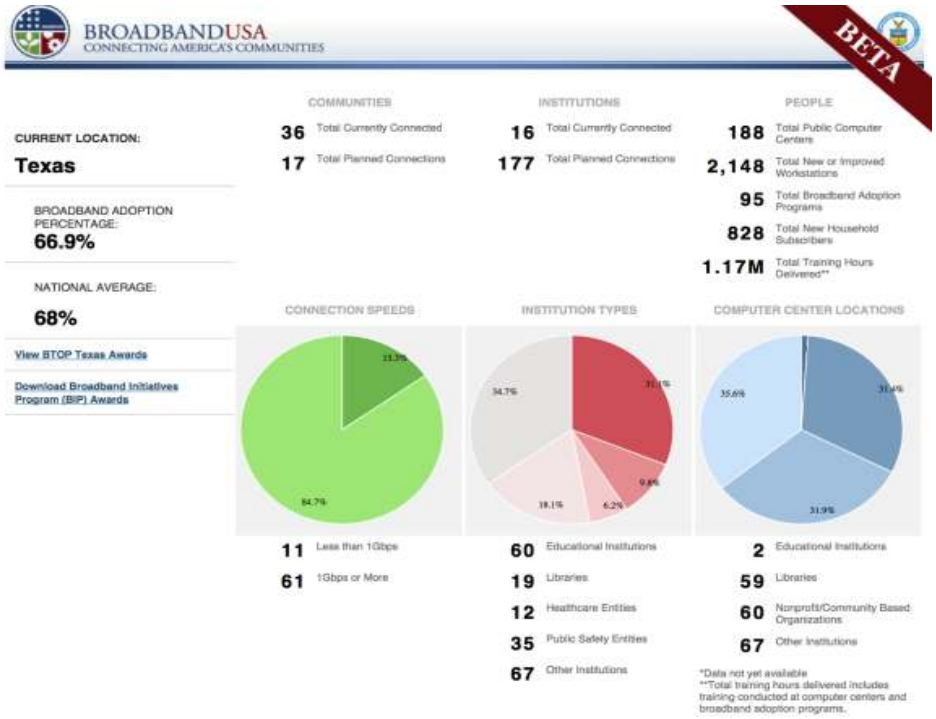
Connected Texas: Broadband Data and Development

Connected Texas, a subsidiary of Connected Nation, is Texas's sustainable broadband adoption grantee, and has received a total of $8,026,000 in BTOP funds. Connected Texas operates as a non-profit organization. The organization's project consists, according to BTOP's description, of components that include state capacity building, technical assistance, local regional technology planning teams, and data collection, integration, and validation. Specifically, Connected Texas is working with the Department of Agriculture to map broadband coverage in the state, to identify and

address gaps in broadband coverage (Connected Texas, "Our Mission"). Connected Texas advocates not just for increased broadband coverage but also for sustainable adoption and collaboration amongst different interests. As shown in Figure 2, Connected Texas reports an adoption rate slightly below the national average, and lower for certain underserved communities such as those in rural areas of the state.

Figure 1

Snapshot of Broadband in Texas



Source:

Chapter 4: Methodology

Research Questions

According to the description outlined by BTOP, public computer centers are anchor institutions serving the public good like a library, hospital, employment center or church. In order to ensure that public computer centers in Texas are meeting the goals of BTOP, we asked the following research question: How do public computer centers serve vulnerable and underserved populations and how do they contribute to closing the digital divide among users? BTOP has an explicit interest in encouraging economic development in underserved communities by way of exposure to employment resources, such as job applications, job training and state benefits, online.

We used two forms of data collection to answer this question: quantitative and qualitative. For the qualitative collection we conducted two kinds of interviews: staff and user. "Staff" refers to the employees of public computer centers and "user" refers to the participants using computers at public computer centers.

Categories of Public Computer Center Samples[35]

We grouped the public computer centers into the following typology.[36]

1. Housing Complexes
2. Multi-Purpose Centers
3. Employment Centers
4. Faith-Based Organizations

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[35] See Table 3 for list and descriptions of all sample sites
[36] It should be noted that there is (weak) overlap in site differences.

5. Libraries

Qualitative Data Collection

We conducted staff interviews to discover whether there were structural or institutional barriers interfering with the user computer experience. We asked three kinds of questions.[37]

- **Organizational Communication**
    - How do you communicate with co-workers, employees elsewhere?
- **Teaching/Training Users**
    - With what computer-related skills do users need help the most?
- **Other Intermediaries Partnerships**
    - Do you work with or receive resources from other organizations or agencies?

Interviewers also asked users of public computer centers to describe their experiences using computers and broadband in these centers, in order to identify the challenges and benefits perceived and articulated by the user.[38]

Guiding interview questions:

- **Purposes/patterns**
    - For what do you generally use the site/center?
- **User Demographics**

[37] See pg X for full list of questions
[38] See pg X for full list of questions

- What is your income, ethnicity, education and age?

- **Digital literacy**
  - What is your computer skill level: beginner, intermediate or knowledgeable?

Quantitative Data Collection

We used a computer program called Yusadge to measure the frequency of computer use. Yusadge measures the frequency of computer use at a given time interval--30 minutes, 45 minutes or an hour. The Yusadge program measures the movement of the computer mouse to determine whether the computer is in use.[39] We compiled the Yusadge data to determine which public computer centers had high, medium, and low computer use. These descriptions were determined relative to computer use of all sampled computer sites. Finally, we collected browser history information to group the kinds of websites computer users visited, in hopes of gaining insight about user patterns and possible motivations for utilizing the centers.[40]

Site Selection/IRB Approval

One of the primary tasks of the class's fall semester component was crafting a research proposal to present to the UT Austin Institutional Review Board (IRB. In creating this proposal, we made a rough outline of questions to ask users and staff in interviews. Those guiding questions were intended to help drive discussion toward some

[39] This may be an inexact metric for this purpose, but provides a way to measure computer use by recording the number of active sessions on a given machine.
[40] Evaluation of these browser history logs is ongoing, and preliminary data/conclusions could not be compiled in time to include with this report.

of the areas where user and staff responses might be most insightful regarding how public computing centers might help address the digital divide.

The IRB proposal also required the selection of specific sites. Constraints of time and resources prevented students from studying all 90 TCC sites; our research team selected 18 of these sites, ultimately conducting 82 user interviews and 34 staff interviews. The 18 sites were selected primarily with the purpose of finding balance in terms of geography, site type, size and level of use. These criteria were evaluated using preliminary Yusadge data as well as observational data from our preliminary visits to many of the 90 TCC sites during the fall semester. For example, the following chart shows the number of machines connected to Yusadge at each site:

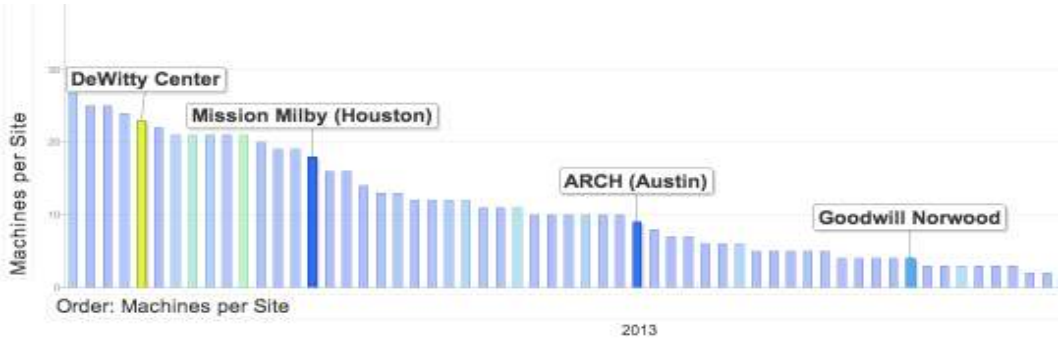

Figure 1: Average Machines per Site (Monthly)

Meanwhile, the chart below estimates the number of hours of active sessions logged on each location's machines in a given month.

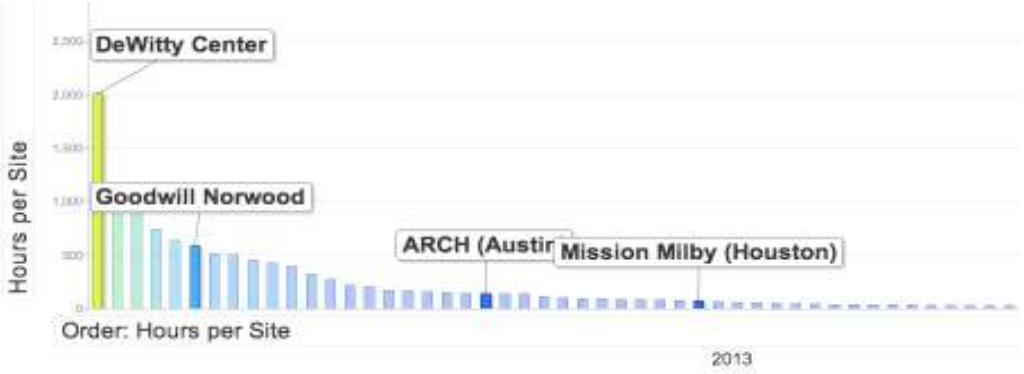

Figure 2: Total Machine Hours/Month (Average) per Location

Finally, this third chart breaks the machine hours metric down further by adjusting for the number of machines present in each location:[41]

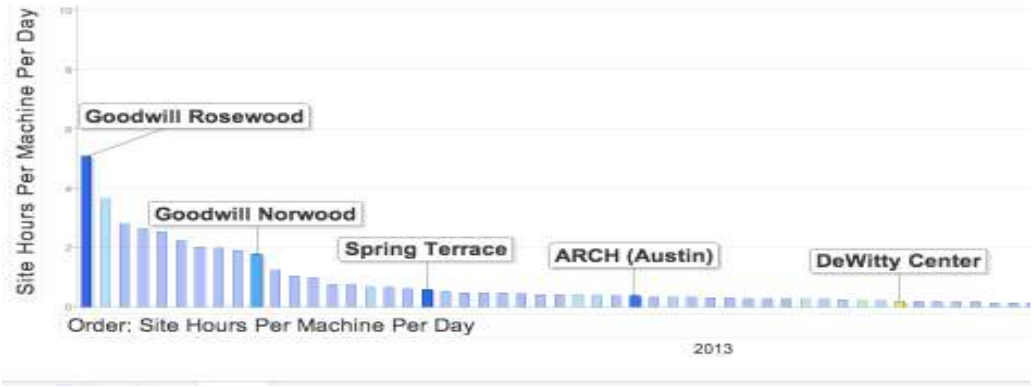

Figure 3: Total Machine Hours/Site, per Machine

The most important thing to note is the substantial variability/range present in these metrics. These initial visits and evaluations of Yusadge data were not intended to give us a perfect representation of what each site was like (we found that some BTOP

[41] It should be added that not all machines were connected to Yusadge, making this an imperfect but best available metric for our purposes of making initial evaluations of sites.

machines outside of the Austin area were not connected to Yusadge, for example). Rather, we sought a broad overview, one that would give us a reasonable basis for site selection. The resulting sample included six sites each in the Austin, Houston, and the San Antonio Metro areas, plus several sites in rural areas some distance from the cities themselves. A list of the chosen sites is provided at the end of this section, accompanied by a short description of each site.

The 82 user interviews conducted at these sites were done with adults aged 18 years or older who were actively using the computer center, or who had recently finished using the center. After the interviews, students created transcripts of the conversations so that responses could be evaluated at the end of the project.

Finally, the figures provided below display the self-reported demographics of our user sample in terms of gender, age, ethnicity, and income/educational level. The two leftmost columns of the chart describing income (figure 6) represent income levels below the federal poverty line:

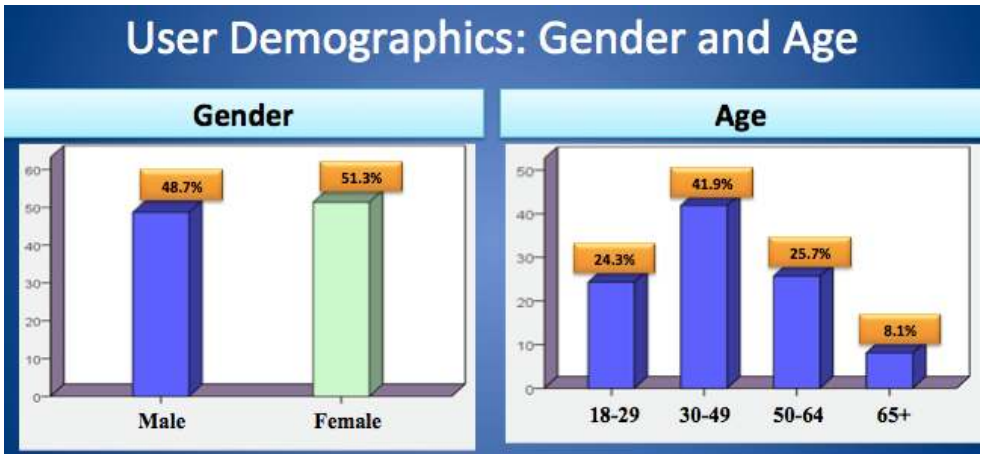

Figure 4: User Demographics (Gender and Age)

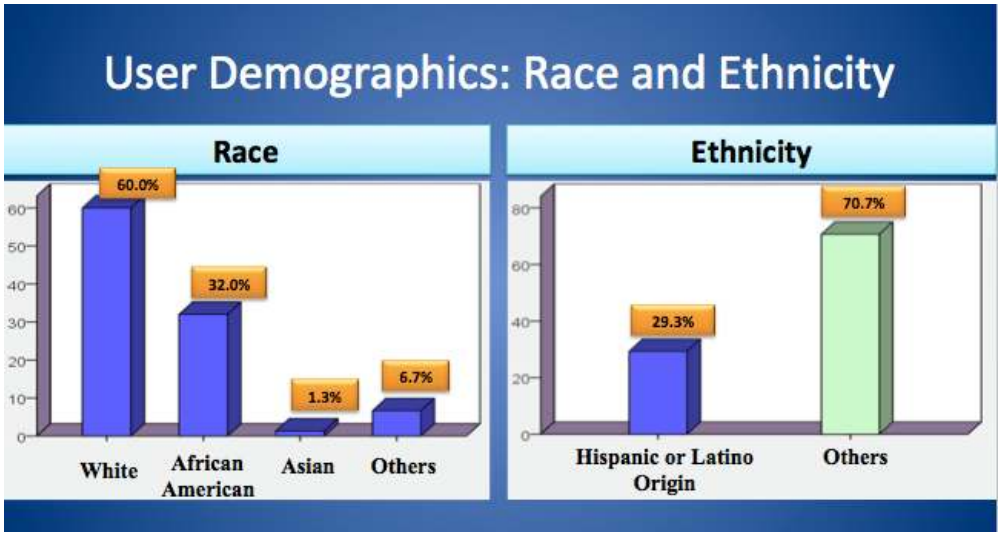

Figure 5: User Demographics (Race and Ethnicity)

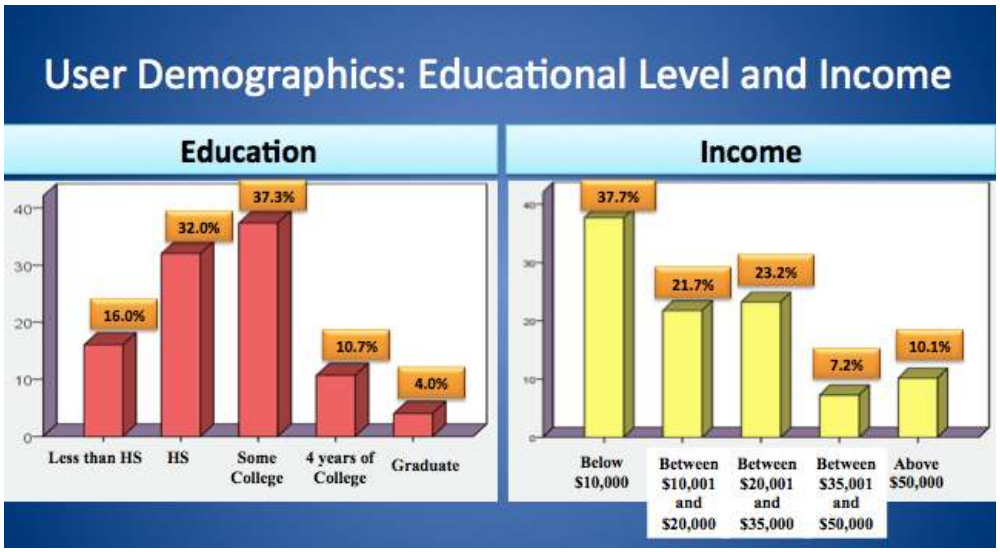

Figure 6: User Demographics: Educational Level and Income

Sites	Population (by Zip)	Description
Austin area		
Austin Resource Center for the Homeless (ARCH)	6,841	Resource center and overnight shelter for Austin's homeless population
DeWitty Center	21,334	Provides employment-related resources & training, as well as language learning
Goodwill Norwood Community Center	49,301	Provides employment, educational and case management services for youth and adults
Spring Terrace	18,064	Single resident occupancy complex for disadvantaged adults
Trinity	6,841	Church-affiliated resource center for homeless/impoverished adults
Ventana del Soul	44,935	Café and culture center providing training and vocational mentoring to disadvantaged, disabled, or underemployed adults. Specializes in serving the ex-offender community
San Antonio and rural areas		
Bastrop Library	25,160	Public library located approximately 30 miles east of downtown Austin; also serves surrounding rural community
Bulverde Library	9,838	Library and social center located approximately 30 miles north of San Antonio
Ferrari Community Family Resource and Learning Center	40,267	Community center housing a *Head Start* center, several city-sponsored education programs, and a TFA-sponsored computer lab
Haven for Hope	55,514	Resource Center for homeless adults in San Antonio
Lockhart Library	17,081	Public library serving Lockhart and surrounding communities
Smithville Recreation Center	9,067	City-owned multi-purpose facility, featuring a computer lab accessible to the general public
St. Mary's Family Learning Center	58,811	Education and training-centered facility, located on campus of Saint Mary's University
Houston area		
Denver Harbor	25,464	Large, multi-purpose center; hosts numerous organizations, including the *Houston Center for Literacy*, *Target Hunger*, and the *Denver Harbor Senior Center*
Mission Milby CDC	20,719	Religious-affiliated multi-purpose community center

		in southeast Houston
Sharpstown Garden Apartments	71,969	Apartment complex located in Houston
Sharpstown Learning Center	71,969	Literacy center located in Houston, affiliated with the *Houston Center for Literacy*
East Side University Village Community Learning Center	32,692	Offers educational assistance and job skills development to Houston-area residents
S.H.A.P.E. Community Center	32,692	Community center located just southeast of downtown Houston; primarily serves the African-American community

Table 4: Sites Visited

Limitations

While we felt our design gave us an adequate cross sample of PCC sites to visit and users and staff to interview, we must note several potential concerns in regard to our data and sampling procedures.

First, one population group not included in this study is non-users, i.e. those who choose not to utilize PCCs. Although some members of this population were present at sites, utilizing resources other than the computing centers themselves, these individuals were not a part of the original research proposal submitted to the IRB, and thus were not interviewed. Speaking with these individuals, especially those without a separate source of broadband access, might give a better sense of why some individuals choose not to use PCCs and give insight as to how outreach to this population group could be improved by PCCs themselves. A second group we did not include in the study was children. We saw ample evidence of children at many of the sites that allowed people under 18, and there appeared to be a clear need for after-school computer access that the PCCs were

answering with their facilities. However, our focus was on adult users and consequently we gathered no data from children.

In regard to finding an adequate cross sample of PCC sites, we feel reasonably comfortable with the 18 sites selected from the 90 Texas Connects sites in operation at the beginning of our project. Attempts were made to balance geography, site-type, and level of use relying on Yusadge data and observations from our initial field visits for making determinations on these last two factors. The resulting sample incorporated a diverse cross-section of sites that, although perhaps not perfectly representative, provides a strong sense of the diversity among these centers. Indeed, no two centers were quite alike.

Additionally, in regards to sampling of users, we feel our study included a diverse cross-section of participants, albeit with a few limitations. For one, only adults were interviewed for this study, as IRB approval of the research design was conditioned upon all respondents being 18 years of age or older. This limitation left a large number of individuals served by the PCCs outside the scope of the study.

Also in terms of the representativeness of the user sample, the timing of our site visits was constrained both by our schedules as graduate students and by the hours of the centers themselves. We may have missed opportunities to speak to certain groups of users who visited PCC sites at times in which we as students were unable to conduct research. For example, we were not available most evenings when individuals who work during the day were more likely to be utilizing PCCs.

Chapter 5: Institutional Ecosystems

This chapter addresses both the internal and external ecosystems of sites. The sites will be analyzed according to four different groupings: Residences, Multi-purpose or Multi-use, Employment Centers, and Libraries.

Internal ecosystem

The internal ecosystem of the centers describes the ways in which the staff, trainers, and users interacted within the particular structural conditions of the sites. More specifically, this refers to the policies that governed the centers, the types of services offered at the centers in addition to computer access, and how the computers were viewed and used by those at the center.

External ecosystem

The external ecosystem refers to the formal and informal partnerships, relationships, and agreements that each center had. These took the form of financial agreements, shared knowledge, shared resources, referral systems, and personal connections. We will map out these connections to explore how different sites integrated themselves into a broader community.

Residences

Internal ecosystem

Residences were subsidized housing projects having a computer lab added to the complex as a resource to offer to residents. The residences' labs were there to provide access to computers and the Internet. Staff members or trainers were there to provide one-on-one support and to monitor the center while it was open. There were no age, use, or time limit restrictions on these computers, as they were meant to cater to the whole community. Users ranged from younger children, who came after school to do work and socialize, to adults, who tended to not have personal access in their rooms. Trainers at one site attempted a variety of programming and activities to attract residents to the facilities. They had pizza parties, taught ESL and computer classes, "flyer-bombed" residents with advertisements for the site, and sought to get a sense of what residents would want out of a computer center.

External ecosystem

The sites we visited had not developed professional relationships outside of their partnerships with the management of the residences and the TFA network. It is crucial to mention that once the BTOP funding finishes, many sites will not have staff to closely monitor and manage the centers, and the management of the residences will be responsible for upkeep of the computer centers.

Analysis

These computer centers were tasked with a difficult job because the idea of a public access center in a residence is not very common and people in the residences

needed to be educated about what the site offered. Staff members were tasked with not only supporting those that were coming into the center, creating an environment as comfortable for a 12 year old as for a 50 year old, but also engaging residents and creating events where people who were intimidated by the site or unsure of themselves would take advantage of the space.

One challenge of doing outreach in the residences was that there was little to no information about what types of services or access residents needed. While trainers attempted to address this knowledge gap through outreach and providing varied programming, efforts in this area must continue in order to maintain the usefulness of the site. As funding ends, information sharing between TFA trainers and those responsible for the sites is of key importance for the growth and sustained use of the center.

Multi-purpose and Multi-use Centers

Internal ecosystem

This group is composed of community centers, public service centers, learning and literacy centers, senior centers, and homeless shelters. While this is a mixed group, each one provided a variety of services or support to targeted constituencies including low-income, homeless, elderly, or immigrant communities. Centers would offer a range of services that included, but was not limited to: access to social services, clothing, free meals, recreational sports, volunteer opportunities, and job search support.

How were computers used?

Computers in literacy centers were used to further the goals of their mission by using them to teach ESL and GED classes. Sometimes, this resulted in users continuing to use the computers for personal use once they had learned the basic skills from these classes. The other centers provided open access for users to use as they saw fit, using a one-on-one support model in which staff and trainers assisted users when needed. Some had a mix of both computer skills classes and open sessions.

Mission Milby in Houston had a unique approach to using the computers that we did not find in other centers. The following is an excerpt from an interview with a trainer that gives better insight into this unique program. The conversation begins after the trainer was asked what he felt the goals of TFA are.

> Trainer: I think the goal of TFA is to help put technology in the hands of those who don't access to it or don't understand it. To teach them the basics of computers. At the same time, TFA has a second branch that offers low-cost computers to those who don't have any. Around here is a low income community. With the free Wi-Fi in the area, they access the Internet for free as well.
>
> Interviewer: Could you elaborate on those programs?
>
> T: There are two programs. “Serve and Earn” and “Learn and Earn.” With “Serve and Earn,” we give you a computer once you have volunteered so many hours. The “Learn and Earn” program is where you come down and learn all about the basics of a computer. The trainer and the user take a computer apart, shows them what the internal component look like and how they work; that way they understand what is going on internally. We give them a basic understanding of how a computer works on the inside. Then we show them how to install software and complete updates. After they are done, we give them their own computer. Every computer we give out is refurbished. We work primary through donations. We people bring in the donated computers, I strip them down and take them apart; I update everything and make sure everything is working property and use refurbished parts. I install basic, free computer software. I run Microsoft Windows XP profession, which is a good, stable operating system and easy to operate. I give them open office, full suite of adobe and java; as well as anti-virus software.

This program could be a model for other sites that are looking to expand the services they offer to include more interaction with technology. However, this is also contingent on there being staff with knowledge, skills, and funding to pursue this particular program.

Some of the sites in the study had ties to churches, and the user interviews at these locations reflected that the religious element was attractive to the users and an important part of their experience in the space. These sites offered emotional and social support for users who could not get this support at home or from other spaces, whether the users had religious ties or not. The following excerpt speaks to these multi-purpose centers' ability to foster a community.

> Interviewer: Okay, let's say you have Internet access at home, and someone dropped off Internet access and a computer. Would you still come to the computer center?
>
> User1: Mmm, probably, because of the environment.
>
> I: Because of the environment? What about it that's uhhh…
>
> User1: Cuz it's drug free, anti-violence, it's peaceful place.
>
> *Response to same question by User2*
> User2: You know it's both friendly and comfortable. You have peace and quiet you know. And then you have other people around who, they can help you.

The support, values, and culture of the center were a draw for the users, in addition to the computers and Internet access. These centers were focused holistically on their users and user needs. The staff and trainers all expressed a passion for supporting

users and helping them to achieve their goals, whether that could be accomplished within the center or through a referral to another location.

External ecosystem

These centers had a rich array of external formal and informal connections. In San Antonio, the learning centers are regulated by the city and shared common policies. All centers only served users aged 18 and above. Another policy mandated that the city would pay for the centers' utility bills; in exchange for this, community college professors were able to use the computers to teach class.

The Houston Center for Literacy (HCL), a broad network of literacy service providers across Houston, demonstrated a unique operating model. Two of the sites we visited were called Demonstration Centers (DC). DCs were charged with demonstrating best practices to the other providers. While each provider operated somewhat independently, they could draw on the resources of the larger HCL network. For example, instead of each individual center seeking volunteers, the HCL headquarters would hold drives and then assign volunteers to the individual providers. This allowed the centers to focus on other issues such as provision of services, development and fundraising, and addressing the needs of their users and clients.

Many staff members were part of a "nonprofit ecosystem" and were aware of their centers in the context of other nonprofits in their communities. Many formal and informal connections came out of personal connections that staff members had prior to working for TFA. One phenomenon we noticed about these increased external networks

is an informal system of referrals. For example, if one site could not offer the client a particular service, the staff would refer that user to another center that could address his or her needs. How did the staff know to do this? Through this "nonprofit ecosystem," staff could use their knowledge of other service providers to help clients find what they needed.

Analysis

It is crucial to point out that these centers have purposes and missions that do not necessarily explicitly include access to technology. The deployment of computers and training was added on in many cases, and while one or two staff members might have been dedicated to overseeing the success of the BTOP program, not all the staff were included in understanding the role and utility of the computers. That being said, many staff members and site coordinators took it upon themselves to maximize the use of computers and came up with creative solutions, like the TFA trainer using them to teach ESL teachers how to use Excel.

The computers were rarely the only draw to the spaces. Were there incentives on the part of staff to focus more time, energy, and resources to highlight the computer center and classes? While we do not have conclusive qualitative or quantitative evidence to argue either side, we believe board members, staff, and other stakeholders should spend time examining this question and how technology access fits into the mission and capabilities of each site.

Employment Centers

Internal ecosystem

Computer usage is tends to be age-restricted in these centers, which cater to adult job seekers. The spaces were designed to give users a structured environment, to help them search for a job. This meant staff monitoring users and keeping them on task to focus on activities that would help them find a job. Some users would take online classes, as well. There was not much interaction between users, but more of a mentorship model established between staff and users. One volunteer and former user said:

> Have them on a schedule. Ask them what they need help with beforehand then give them a structured plan. You have a lot of people that cannot focus. You can't just give them a computer for a half-hour and say, there you go. They will just get on MSN or yahoo and read the news. Which is ok, but it isn't their purpose.

External ecosystem

We found little in the way of external connections that developed into formal relationships, but we did speak to some homeless users who made it clear that they were aware of the variety of centers providing services to the homeless community. This will be discussed further in the "User" section.

Analysis

Workforce centers can play a crucial role in providing services to job seekers who do not have sufficient skills, knowledge, or connections to secure employment. That being said, we believe there is a greater possibility for exploring less restrictive computer usage models to encourage users to engage with technology to find employment.

Libraries

Internal ecosystem

The libraries we visited served rural communities. They explicitly catered to all age groups and socioeconomic levels, as they are intended to be a resource of information for all. Libraries are public sites of user content *and* access, and have continued to serve in this capacity into the digital age. The American Library Association's code of ethics reflects the multifaceted nature of this mission:

> We significantly influence or control the selection, organization, preservation, and dissemination of information. In a political system grounded in an informed citizenry, we are members of a profession explicitly committed to intellectual freedom and the freedom of access to information. We have a special obligation to ensure the free flow of information and ideas to present and future generations.

The interior design of the libraries was unique, and will be described in more detail in the following chapter on Adaptability and Flexibility. Essentially, staff members were able to separate computers into different groups across the library, which was in part because of the ample physical space and funding available. The goals as expressed by staff were to make the library an open and accessible resource for the community, and to create a comfortable space for all.

External ecosystem

The Bulverde Library, belonging to a community that established it as a separate tax district, was able to earn revenue and consequently make more improvements to both the building and resources they offer. The Bastrop Library had made connections with

Dell and H.E.B. to fund certain projects and expansions. Fundraising and development seemed a strong suit across the libraries, which could also be a function of the library being a particularly well-known public resource center and having consistent, while not necessarily sufficient, public funding. In terms of technical support, the libraries had access to the city technical support assistant, but staff also adapted their role to attend to the technology needs of the users.

Analysis

Libraries play an ongoing role in the provision of knowledge and information, and serve also as a public access point. Community organizations, political leaders, and citizens can use the space for personal growth and to foster community. Access to technology is imperative not only for seeking information, but for community building and knowledge sharing through social networking. While conversations are happening in libraries across the country about the role of the Internet and new technologies, other providers' participation in these discussions may create an avenue for growth and partnership, as they share their experiences with the library community.

Flexibility and Adaptability

The second major theme that emerged from our analysis of interviews was flexibility and adaptability—the ways in which different PCCs adapt to and relate to a diverse set of users. Based on our site visits and staff interviews, three subthemes emerge: individual skill levels and needs, hours and accessibility, and PCC layout and design.

We collected supplemental information on each of these subthemes through direct observation at PCCs, online research, and analysis of user interviews conducted on-site and over the phone. However, we primarily focused on interviews with on-site staff, program specialists, trainers, and volunteers. Below is a brief description of the types of positions, main responsibilities, and how each position was typically funded or supported.

Type	Responsibilities	Funding and Support
On-site Staff	Primarily responsible for on-site duties related to the site in which they work and not the PCC (e.g. reference librarian, social worker, development specialist, intake specialist, program coordinator); required by the grant to provide an average of 3 hours of support to the PCC per week; secondary responsibilities include monitoring computer lab; providing basic technical support; informal training; volunteer management; and data collection	Dependent on site funding, varies among sites, includes city, state, private and public funding, grants, and donations

Volunteer	Assist with user intake and training, basic technical support, data collection	Austin Free-Net Special partnerships
Program Specialist	Primarily responsible for the PCC, monitoring the computer lab, providing basic technical support, managing volunteers, data collection	Texas Connects Coalition Austin Free-Net Technology for All
Trainer	Responsible for 1-5 PCCs in a particular region, providing formal training, program support, and data collection	Austin Free-Net Technology for All

Table 5: Position Descriptions

Individual Skill Levels and Needs

According to on-site staff, program specialists, and trainers, typical user needs ranged from computer basics (e.g. learning how to use a mouse, execute keyboard shortcuts, restart the computer) to more technical, case-specific issues (e.g. uploading photos from a personal device, posting items for sale online, resolving minor technical issues related to computer programs, such as Microsoft Office Suite). Program specialists emphasized the diversity of technology needs by citing examples from specific users or types of users. Many also noted the differences between older and younger users, especially the types of questions they asked. Describing interaction with younger users, one trainer explained:

> The kids ask me a variety of questions, which forces me to do the research and provide an answer. Most of the time I have an answer for them, but I tell them to come to me for any type of question. I tell them if I don't know the answer, I am meant to be a resource and I will get an answer for them. But more than that, I try to help them learn how to find the answer themselves. I tell them to ask Google and other search engines to help them help themselves.

On-site staff and trainers also emphasized the need to fuse specific technical training with computer fundamentals, including the basics of using the physical machine (e.g. turning it on and off), understanding how web browsers work, and setting up an email address. The reported need to teach basic digital literacy to many users is important to note, especially at sites where the computers supported other primary organizational objectives. At some sites, computers supported primary organizational objectives such as preparing a resume or completing online job applications. However, the reported need for users to learn basic digital literacy occasionally challenged the ability for staff to accomplish other goals because users had to first learn fundamental skills before they could approach a more complex task, such as filling out an online job application. As one trainer stated:

> A lot of people want to know about networking sites. But I can't answer these questions in such a way that they want to hear because…For example, to use this networking site you need to sign up, and that requires an email and password. Do you have an email account? No. Here is what an email account is and what it is used for, and here is how you set up an email. And so forth. So a single question turns into an introduction to Internet fundamentals. It's all interconnected. So I try to stress the fundamentals.

However, this was not always the case, as staff members also described users that were experienced computer users and rarely if ever asked questions about computer basics.

In addition to supporting diverse technology needs, on-site staff and program specialists also emphasized their role in helping reduce anxiety towards new technology, including issues of online security or access and understanding of Internet fundamentals (e.g. how to open multiple browser windows, close unwanted pop-up windows, or read and enter CAPTCHAs). In conjunction with these issues, trainers noted the need to make technology relevant as a tool for reducing anxiety and helping new or inexperienced users develop or maintain interest. As one trainer mentioned, "Once you teach someone one thing, it just opens up a floodgate of questions. It goes back to that confidence; once they have the confidence to ask, they may ask anything. If they think you know computers, they think you know everything." These issues were more often associated with older uses and users lacking digital literacy.

Hours and Accessibility

Hours and accessibility of the sites within our sample varied, both between the different types of sites and among individual sites. In general, all sites had at least one on-site staff member or program specialist available to assist users during regular hours of operations. Urban sites were typically open during regular business hours or until 6 p.m. Rural libraries had longer hours and were also open on weekends. Due to the design limitations of our study, we were not able to interview users who were unable to attend PCCs in our sample during regular hours of operation; we are therefore unable to provide much evidence regarding any center's ability or inability to address the issues created by limited hours of operation. Some trainers did mention that specific sites had

experimented with extended hours of operation in the past, but it is not known whether these efforts were successful at extending service to users who would not otherwise have had access to the PCC.

Computer usage time limits also varied significantly by site. In general, limits ranged from 30 minutes to 3 hours, and some sites provided unlimited access or only enforced time limits when users were unable to access workstations during periods of peak demand. Sites that enforced time limits tended to require users to sign in on paper or electronically (e.g. at public libraries) before they were assigned a workstation. Our research also showed that some sites (such as public libraries and some employment centers) provided special time limits for users pursuing tasks that required more time to complete, such as online GED preparation or continuing education classes.

Depending on the type of PCC and staff members present, some sites engage users the moment they enter the doors of the building or computer lab, whereas other sites—mainly libraries, learning centers, and resident centers—tend to have a more hands-off approach to user support and interaction. Our observations and interviews indicated that employment centers and homeless shelters tended to engage users when they entered the site, partly due to higher demand for workstations, the need to schedule session times, and the focus on ancillary services provided in conjunction with computer access, such as focused job search assistance at employment centers. The following quote from a trainer at Dewitty Job Training and Employment Center provides an example of the intake process..

> Most of the time people come in, they walk into the doorway and they tell me they need a job. So from there I have to follow certain steps and ask them certain questions. 'Oh, okay. What kind of job are you looking for? What have you done in the past? What do you like doing? Are you looking for a full time job or a part time job?' A lot of people come in here to get a city job. And the city jobs require a GED and a driver's license. So I have to ask them if they have that. If they don't, then I will look other sources like Craigslist or Indy.com. But typically Craigslist has a lot of positions that don't require a degree.

PCC Layout and Design

The layout and design of PCC computer labs was fairly consistent across most centers, with the typical lab located in a separate room off to the side or separated by some type of partition from a larger room. However, rural libraries, distinct from other centers both in location and use, offered one of the more notable exceptions to this layout: They divided computers between youth and adult, therefore providing a buffer between different types of users. Site staff mentioned that this division helped prevent distraction from noise and allowed for different levels of filtering on selected workstations.

Outreach & Communication

In an application for BTOP funding in 2009, the Texas Connect Coalition members expressed, perhaps inadvertently, the challenge they would face when considering how best to reach potential computer users.

"We and our partners have to be welcoming, flexible, aware of our audiences and their issues, and genuine in our passion in order to attract and keep attracting people to these life-changing tools," the application read.[42]

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[42] See http://www2.ntia.doc.gov/files/grantees/technforall_pcc_application_part1.pdf

As pointed out this application for funding, the population the coalition was hoping to attract is diverse, spread among more than 90 sites in a wide range of communities. Additionally, many of the sites that house the centers differ greatly from each other in terms of their constituencies and the programs they offer. The application noted that each center would develop its own method of reaching out to potential users.[43] The coalition also said it would reach out to the community through businesses and churches for potential customers.

It's clear from reading the proposal that the Texas Connect Coalition recognized early on that it would not be able to design a one-size-fits-all approach to outreach. Interviews with users and staffers over the last year confirmed this idea.

Why people show up

Interviews with users and staff revealed that users showed up to centers for various reasons, depending on each site's specific purpose. For example, numerous users who frequented computer centers in libraries said they first showed up to check out books, then started using available computers. Staff members also noted that various patrons would notice the computers after signing up for a library card. Some users said they had frequented the library for years, but after the computers were added, they started showing up to solely use the computers. Proximity to the library may be another factor influencing users' attendance; most of the users said they lived within several miles of the sites.

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[43] See http://www2.ntia.doc.gov/files/grantees/technforall_pcc_application_part1.pdf

At other locations, users reported that they first went to the locations for other services, such as to apply for WIC benefits at a community center or for a GED course. The data did not clearly indicate whether these users ever moved past using the locations mainly for other services and began looking at the computer centers as a primary feature, as they did in libraries.

Interviews showed that people who frequent each type of center belong to different ecosystems, depending on the purpose of the center. For example, we found that a person going to a job center would likely be looking for employment, and this limits the center's type of user. Such centers often had restrictions on what work could be done on the computers, so even if someone stopped in from the street, the center would limit that person's computer use to job searches. Other centers are located in residential facilities with restricted access, limiting outreach to residents; non-residents would be unaware of the computer center's existence.

Interviews revealed that restrictions on use and access limited centers' prospective clientele, and therefore the methods of outreach differed among sites. What worked for a library, traditionally a hub of community gathering, would not necessarily work for homeless shelter, such as the Austin Resource Center for the Homeless, or ARCH. And some users said they frequented the centers just because the Internet service they have at home is slower than the center's.

Methods of reaching users

As diverse as the populations and communities the centers serve proved to be, our

research showed that these centers generally used traditional methods of advertising to reach users. Both staff members and users mentioned fliers as a form of outreach. In some locations, flyers and posters were hung near the computers, advertising classes for specific skills, such as putting together a resume or learning Microsoft Office.

"I think they just find out by coming in," said one staff member at Austin's Trinity Center, which mostly serves the homeless population. "It is a small space so when they come a couple of times they notice people signing up for something and then they ask. We also have a small board with the AFN sign. It is very visible."

On other occasions, staff members reported going out and handing fliers to potential users, sometimes at community events. A staff member at DeWitty Job Training and Employment Center in Austin explained, "So we literally go. Let's stand out. We hand the flier to the person and say, 'You need to come. You need to come by and see. You need to, you know, use a computer. We can help your resume.' So we actually interact with the community and the clients."

In other cases, specifically at work centers, case managers would point out the computers by directly walking people to them and showing them how to do specific tasks, such as searching the Internet for a job or filing out an online application. A user at Austin's Goodwill Norwood job center described this experience: "Last time I was here, there was some lady there, my case manager had this lady helping me applying for a job online."

Staff members reported that word of mouth has proven to be the best method to reach potential users. And user interviews seemed to confirm this since many users said

they learned about the centers from friends or family. A number of them reported inviting friends and family themselves, spreading the word among those who would trust their opinion.

One Dewitty user seemed to appreciate a friend who pointed her toward the computers: “Meredith here ran into me at a shop like an angel and made me come up here.” Another Dewitty center user reported learning of a facility at a local spa, explaining, “First time ever. I just met her yesterday while she was out getting a pedicure at a shopping strip mall. I walked into the nail spa looking for a job. She overheard me and told me that this center has computers and resources that would help me get a job, so here I am today. She told me that I should stop by and put up my resume.”

In at least one instance, a staff member at Houston’s Denver Harbor Multi-Service Center said that fliers were initially posted around the neighborhood, but the computer center now relies on word of mouth to attract users. Despite the success of word of mouth, in some instances it did not work. Some users said they told friends and family about the center they frequent, but the potential users were reluctant to venture over to the centers. “I told my friends about the center but they don’t come,” one Denver Harbor user said. When asked why, the user replied, “They are probably too shy; afraid to come into the building only to use the computers.” Another user at Denver Harbor said the people they told about the center likely decided not to take advantage of the facility because of proximity. “It’s too far away, maybe. They seem interested, but maybe they just don’t think about it.”

Many of the locations that house computer centers also promote them on their websites. For example, the Mission Milby Community Development Corporation in Houston advertises "a free wireless network for the community in collaboration with Rice University…[which] provides training for persons seeking to improve their computer skills." It advertises the computers on same portion of its website that promotes other programs, such as ESL and GED classes and a youth after school program. However, staff members at locations that advertise on their websites or through social media acknowledged that potential users are not likely to see the advertisements since most of them are not familiar with computers and would probably not have access to the Internet outside of the centers themselves. None of the 82 users interviewed for this study said they learned of a center through Internet searches.

Internet-enabled Mobile Device Usage

Interview responses to questions about Internet-enabled mobile device usage revealed five major themes. First, we found inconclusive evidence about Internet-enabled device usage at the sites. Some trainers reported observing more mobile devices being used at the sites; however, few of the users we interviewed said they owned or used these devices. Second, unsurprisingly, trainers reported seeing a recent increase in mobile device usage among younger users and less so with older users. Also, the trainers and staff that reported seeing mobile device usage tended to work in more urban, populated sites. Those working in rural areas were less likely to report increased usage. Third, staff interviews revealed that younger users are asking trainers more questions about mobile

devices. Fourth, staff impressions about the overall usefulness of these Internet-enable devices were mixed. Some expressed excitement, others expressed concerns and doubts. Finally, staff and trainers demonstrated an understanding of the trade-offs when comparing brick-and-mortar desktop computer centers with wireless mobile-focused strategies.

Mixed Reports on Mobile Device Usage

Many TFA staff members interviewed for the study observed an increase in Internet-enabled mobile device usage in recent months, particularly among younger users and at more urban public computer centers. For example, one staff member at Bastrop Public Library remarked, "we [see] so many people using their laptops now. But, even a lot of the older people now are starting to use their iPads. People wander through the library and they're all on their iPads." Similarly, a trainer at Sharpstown Apartments reports "most of the users here are young and do use smart phones. I teach them how to save their data plans and hook up to the Wi-Fi here at the center."

However, when researchers asked users if they had a cell phone or mobile device that could connect to the Internet, very few said they owned or used Internet-enabled devices. Trainers may be overestimating how many mobile devices they see, or our small user sampling, at least in this particular dimension, was not representative of the user population on the whole. Wi-Fi data would be helpful to reconcile these inconsistent findings, allowing researchers to observe the number and types of devices connecting to a router. We do have Wi-Fi data for Bastrop Public Library that shows heavy mobile

device traffic connecting to the Wi-Fi broadband. Unfortunately, we do not have this data for the other sites in the study so we cannot make any definitive claims.

Demographic Trends with Mobile Device Usage

Prior research finds variation in Internet access and usage among different demographic groups, especially in terms of home high-speed broadband access. As of 2013 Internet use remains strongly correlated with age, education, and household income, which are the strongest positive predictors of Internet use (Zickuhr & Smith, 2012; NTIAb, 2013). Consistent with this literature, we identify a pattern in the staff /trainer responses that suggests Internet-enable mobile device use is associated with age and income among rural and urban areas (with low-income populations concentrated in rural communities). Specifically, staff members and trainers who work predominately with younger populations located in or near more developed areas (e.g. Austin, Houston, San Antonio) reported more smartphone and other mobile device use. Conversely, trainers working with predominantly older generations in rural areas observed less mobile device usage among users.

One trainer working at multiple sites with demographically distinct populations supported this finding, reporting that in the remote, rural community of Flatting most of the individuals who come to the PCCs and libraries are senior and retired users who are very intimidated by smartphones and mobile technology. The trainer observed: “I actually had to explain to several older users that they do not have to necessarily get a new phone or sign a new contract to get the Internet on their phone.” In contrast, on the days when this trainer works at the PCC near the more urban city of Schulenburg, he/she

states that there is a larger fraction of younger users near the center and estimates that about half of the PCC users have smartphones with Internet capability.

Younger Users Ask Trainers More Questions about Mobile Tech

In addition to observing PCC users engaging with more Internet-enabled mobile devices, several trainers commented on younger users asking them more questions about mobile-devices. One trainer remarked "two of my younger students came in [and] asked about tablets with Windows 8 capability; they are very excited, and one actually purchased a Windows 8 tablet and is waiting for it in the mail." Another trainer who works at multiple sites in Leon County & Madisonville said, "I have more [users] coming up to me with smartphones and asking questions about how to use them." One of the trainers at Sharpstown apartments stated, "I've had classes in the past where I basically[...] teach people how to access Facebook on a phone."

Varied Staff Opinions about the Costs and Benefits of Mobile Technology

Trainers and staff displayed a wide spectrum of feelings about Internet-enabled mobile devices; some acknowledged the potential of mobile devices while others expressed skepticism. Trainers who were excited about PCC users utilizing mobile devices like laptops, tablets, and smartphones contributed several observations., One trainer indicated that some users are initially challenged by the interface or operating systems on these devices but learn quickly, stating, "at first [users] are scared or intimidated, but once you show them how to move stuff with their fingers and you

remove the mouse and keyboard, it takes 10 minutes and they seem rather comfortable navigating around on the technology." This interviewee helped develop a training course for the touchscreen interface on Windows 8. The trainer stated, "when Windows 8 released for tablets, I pushed to let our more frequent users know about the technology."

Similarly, a trainer at Denver Harbor stated that, although users exhibit the same technological hesitance with smartphones as with computers and the Internet, he believes "touchscreen interfaces are the future." In fact, this trainer expressed a desire to take users to the Microsoft store in the Galleria mall as a field trip, to allow the users to interact with Windows 8's touchscreen interface.

Some TFA specialists explicitly supported laptop usage as a useful step forward toward mobile devices. A staff member at SHAPE learning center reported "yeah, I could see how laptops could be a great thing because they are more mobile. They could actually go into the classrooms, instead of having one room designated for [a] computer lab that could actually become another classroom and we would have a mobile computer lab. So I could see how that would be very good and very useful." Other staff members and trainers appreciated laptops because they allow trainers to turn any space into classroom, evoking this notion of a "mobile lab."

On the other hand, some of the TFA staff did not feel mobile devices had a place serving users in public computing centers. One staff member and trainer at Mission Milby explained why tablets are incompatible with these sites. Months ago, TFA purchased ten Apple iPads and ten Samsung tablets and gave them to program specialists at different sites for 30 day trials. Because the users do not have any claim to a specific

tablet, the tablets cannot be personalized, thus preventing users from customizing the device for their personalized needs. While users were initially enthusiastic about the tablets, PCC users quickly lost interest after they realized they had to return the tablets. Moreover, users found it difficult to "check-out" the same device during their next visit. In addition to the personalized nature of tablets, the staff member commented on the challenge of monitoring how users were using the devices. He worried "what would be on it when it is passed around"--tablets could exchange hands with inappropriate content preloaded on different apps in the tablet.

Another staff member at SHAPE learning center criticized tablets for being less productive than computers and laptops.

> With a tablet, to me, you lose a lot of productivity, you know, from experience...[tablets] have their apps where it kind of looks the same, but not really. iPads do not have USB, you know, there are just too many things. To me the iPad, it's just a fun-pad. I don't see it as a productive-pad. And not to mention, I don't know if you've ever had to type on an iPad. It's this [clicking on the table with two index fingers]. It's on screen.

The staff member expressed a strong distaste for Apple products and the iOS operating system. "I will say from my experience, I mean, from our company we got iPads, like, for when we go to meetings and stuff. I hate it, it is not compatible with Microsoft, at all...like, a good 90% of all businesses use Windows, not Mac." Another trainer shared this bias towards Windows:

> To be honest, I am a little biased when it comes to operating systems. We have iPads and I will get them out and show them what it can do. But you got to understand, in the rural areas, I have to careful about getting people excited about

> technologies that are not going to be cost efficient—because many of these users cannot afford Apple products.

This last remark alludes to another reason why many staff members expressed concerned about the feasibility and practicality of widespread mobile device usage. Several staff and trainers doubt that a large portion of PCC users could afford these Internet-enable mobile devices and doubt private industry will supply that infrastructure necessary to provide a quality wireless connection outside the PCC. Staff and trainers consistently reported that cost and adequate Internet speeds are a strong barrier to digital access in rural communities. As one staff member states, "the primary challenge in rural regions is connectivity. In Houston, however, the community cannot afford devices." The staff member continued, "it is crucial to have good bandwidth in order to have a good experience with the Internet. Most of the sites have Wi-Fi, but the Wi-Fi is not very powerful, i.e., it does not extend very far."

Further describing the challenge, the staff member remarked, "the sites have had to provide their own connectivity, and one of the major broadband Internet providers in the area is currently banned because the Internet service is too slow." Comments from trainers at multiple sites in Leon County, Madisonville, and Centerville support this testimony; one said "Financially, most of the people in the rural areas cannot afford to pay for computers.... But the biggest issue is getting [Internet and cellular] service; like in Centerville, you go a few miles outside the center of the city and you don't get a signal…right now one side is on probation because it's bandwidth is too slow."

However, in rural areas with predominantly older populations it is still unclear whether demand-side or supply-side factors create the primary barriers to digital inclusion. A 2012 study by the Pew Research Center finds that among current non-Internet users, almost half (48%) say the main reason they do not go online now is because they don't think the Internet is relevant to them—often saying they do not want to use the Internet and do not need to use it to receive or share information (Zickuhr & Smith, 2012). In other words, if low-cost, high-speed broadband and smartphone data plans were available in rural communities, it is unclear how these populations would change their Internet usage behavior.

Trade-offs between Mobile and Desktops

To elicit more complex responses, we asked staff to respond to a hypothetical scenario: "Assume policy makers are considering a proposal that would shift public funds into expanding wireless broadband access to rural communities and subsidizing costs for Internet-enabled mobile devices and data-plans (smartphone, tablet, laptop, etc.). How does this alternative use of funds compare to the funding of free, open-access public computing centers with technology training classes?" On the whole, staff and trainers paused several seconds to think deeply before responding and expressed an understanding of the tradeoffs that come with any strategy aimed at bridging the digital divide, whether a brick-and-mortar desktop model or a more decentralized approach harnessing the potential of wireless Internet and mobile devices.

Although responses varied, we find that nearly all staff and trainer responses explicitly recognized the macro-level tradeoff presented by the hypothetical scenario and

highlighted benefits and cost with each strategy. A technology specialist interviewed at Mission Milby stated that “desktops at home are becoming a rare thing. They are becoming a personal server you can remotely access through a mobile device, laptop, or tablet. Now the mobile devices cannot yet run all the programs I need to do my job... so I don't think the desktop model will die completely. However, I think laptops and mobile technology will enter more homes in the future.”

One particular trainer’s statements summed up a key aspect of the digital inclusion challenge, as the trainer observed that a mobile strategy would likely favor younger users, while a desktop computer center strategy would likely favor older users and those who are unable to conveniently access transportation. Some group is going to be left out.

With the PCC, it is difficult to reach users, particularly the younger users who have the mobile devices and don't need the centers. They can just run around and still get the Internet. Personally, I still want to push for the older users who got left behind. The centers really help them. But installing the infrastructure [broadband access and training at the computer centers] is only gonna help those who choose to take advantage of it—so many older users still miss out on the advantages. But that is the same problem with those wanting to fund more towers for wireless signals. So really both solutions face the same issues. That is a really tough question.

Chapter 6: User Experience with the Sites

Digital Literacy

The term "digital divide" refers to the disparity in access to computers and the Internet among various segments of the population. This remains an important area of inquiry. However, the increasing penetration of computers and broadband access seems to have reduced gaps in access between whites and minorities, men and women, young and old, the well educated and the less educated, and the rich and poor, as well as between urban and rural dwellers. Nonetheless, providing people simply with access to computers and the Internet does not solve all the problems of digital divide. The focus of the digital divide is shifting to questions of discrepancies in digital literacy skills and usage across population groups. This chapter will consider these questions in the context of our research findings.

Computer and Internet Skills

In order to know the users' digital literacy levels, we asked the users first to self assess their levels of digital literacy skills by giving them three levels to choose from: beginner, intermediate, or knowledgeable. Then, we asked them to further describe what kind of computer and Internet tasks they can or cannot accomplish, in order to compare these self-assessments with established guidelines of digital literacy.

Based on the interviews, the skills self-described by the users themselves were mainly categorized into four types: basic computer skills, skills of using information processing applications, Internet information skills, and Internet communication skills.

The first two types of skills are related to computer skills while the last two types are Internet-based skills. The basic computer skills refer mainly to whether users know how to complete basic tasks, such as opening and saving files, operating an Internet browser, typing, copying and pasting, as well as using flash drives. The skills of using information processing applications are related to their capability of using Microsoft Office Suite, especially Word, Excel, and PowerPoint. Internet information skills involve the capacity to use the Internet as a means of fulfilling informational needs. Skills include using Google to search for general information, using job-related websites like Craigslist to search for job information, watching videos on Youtube, downloading music, and reading news on Yahoo. Internet communication skills mainly refer to the capability of using online communication applications to communicate with other people, such as using email, social network sites like Facebook and MySpace, and chat-rooms.

These skill-based evaluations focus primarily on computer and Internet skills at the operational level. Other considerations of digital literacy, such as the ability to discern and evaluate information and opportunities online, seemed to be less of a concern with the PCC users we spoke to. Only a few users referenced privacy concerns related to sharing their personal information online, awareness of which is frequently categorized as an essential a digital literacy skill. These main skills are summarized in the following table:

Basic Computer Skills	Information Processing Applications	Internet Information Skills	Internet Communication Skills
Open and Save Files	Word	Google Search	Email
Browser Operation	Excel	Job-related Websites (Craigslist)	SNSs (Facebook and MySpace)
Typing	PowerPoint	Youtube	
Copying and Pasting		Music Downloading	
Flash Drive		Yahoo (news)	

Table 6: Computer and Internet Skills

Digital Literacy Levels

These skillsets (listed above) not only reflect users' digital literacy levels, but also their needs in terms of what they want to learn. The users are categorized into three types according to their self-assessment of the levels of their digital literacy skills—beginners, intermediates, and knowledgeable users. Most of the beginners had very limited knowledge of the computer basics, let alone the other three types of skills. Some users reported needing assistance with basic computing tasks, like typing, copying and pasting. A few individuals noted that they had not used computers before starting to visit a PCC site. For example, one user from Goodwill Community Center recalled his first experience with at the site a week earlier: "Well, see, that was like my first time. But other than that, I had never ever used a computer. I had always had a tough time, you know, with a computer. It was something completely new for me."

As for the self-categorized intermediates, most of them had basic computer skills and Internet information skills: They have the capability to use Google to search for what they need, and they know how to watch videos on Youtube, for example. In terms of Internet communication skills, some still had problems with email, (especially regarding attachments) or using Facebook, while others reported successfully using these tools to interact with their family members and friends or to look for jobs. For example, when asked how he could describe his computer skills, one user from Bastrop Public Library stated, "I'm going to probably have to say intermediate. I'm not really kindergarten, but I'm certainly not college level either." When asked to further explain what he meant by this, he responded, "I can use e-mail if there's not a big glitch. Sometimes I get messages and I don't know what they mean. And so I will say I try not to do anything I can't do."

In terms of using Word, Excel, and PowerPoint, most of the intermediates knew what these applications are, but had limited experience in actually using these programs. Some users were able to accomplish most of the tasks listed in Table 6. These users are at the same level with those knowledgeable users in terms of basic abilities, but are more conservative and still categorize themselves as the intermediates. For example, one user from Lockhart Public Library (a college student) described her digital literacy skills:

> I guess intermediate, in the middle. I am knowledgeable enough to do what I have to do. You know, I can email, look up different documents, or you know, I can look up different books for references, articles, or things like that. I know how to sort things. I can write a formal, like, paper and essay. Especially towards things like that so I can do well in school. It's not just so much of the computer knowledge that I have. I just use it cuz I have to.

As for the knowledgeable users, they defined themselves as masters of almost most of the skills listed above. Besides the basic computer and Internet skills, most of them knew how to use Microsoft Office programs to a certain extent. For example, a user from Bastrop Public Library stated:

> [I'm] beginner in some aspects, but somewhat knowledgeable. [Beginner…] When it comes to coding, or setting stuff up, or something like that. [Knowledgeable…] Just on other things…social networks. Like if you need help with Facebook, or MySpace, I'll be able to help you out. But with other things, like logging in or Word or any of the Microsoft products, I can give you a basic knowledge of.

Quite a few of these users had used computers and the Internet for years, and some were currently or formerly engaged in computer and Internet related jobs, such as having been a web administrator or computer technician. Nevertheless, there were still some self-assessed "knowledgeable" users who had very limited knowledge of using Word, Excel, and PowerPoint and want to learn more of these skills. Their levels of digital literacy skills were more similar to those of the typical intermediates. Thus, the categories of intermediate and knowledgeable users tended to overlap. Additionally, the users within these two categories were more heterogeneous demographically than those in the "beginner" category.

However, as noted above, the users we interviewed are usually less educated, with more than half below the federal poverty line (as noted in Chapter 3). We should also note that although only 36% of users classified themselves as "beginners," the classification of these intermediate and knowledgeable users is based on self-assessment, and might differ from determinations based on published criteria for digital literacy. Even

though they represent those having higher digital literacy levels in the PCCs, for example, self-described "knowledgeable" users often had narrower computer and Internet skills then those required in published guidelines for being considered "knowledgeable."

Assistance and Training

Since providing people with only access to computers and the Internet cannot completely solve the problems of digital divide when considering digital literacy and usage inequality, assistance and training are necessary in order to improve users' digital literacy skills. Furthermore, other skills besides digital literacy skills of the PCC users need to be improved as well in order for them to fulfill their life goals. Thus, this section will analyze what kinds of assistance and training the users need and usually obtain in the PCCs, paying attention to both technological and other non-technological dimensions. In general, the users of the PCCs can get help from both trainers/staff and peer PCC users.

Assistance and Training from Trainers/Staff

In terms of the help or training users can get from the trainers and/or staff, there were two models. The first model involves one-on-one assistance, which is less structured and more flexible and tailored to users' specific needs. The other model is based around more structured/formal class-based training.

One-on-one Assistance

Based on the interviews, we found that the help users could get from this one-on-one assistance model can be categorized into two types: technological and non-technological. For technological assistance, users could learn basic computer skills, non-

job related technological skills, and job related technological skills. The questions that the users asked about basic computer use mainly focused on how to type, copy and paste, and print. They also sought help from the trainers/staff regarding how to set up Facebook and email accounts. On the other hand, some users only wanted to know specific computer and Internet skills for job hunting purposes, such as how to fill out an online job application, how to use Word to write a resume, and so on. In terms of the non-technological assistance, the users usually asked questions with regards to GEDs, general job application process, job availability, and how to write a good resume. The categorization of the one-on-one assistance is summarized in Table 7 below.

Technological Assistance			Non-technological Assistance	
Computer basics	**Non-job related**	**Job related**	**Non-job related**	**Job related**
Typing Copy and Paste Printing	Email Facebook	Job Search Online Job Application Microsoft Office Suite	GED	Job Application Job Availability Resume Writing

Table 7: One-on-one Assistance

Class-based Training

In addition to the one-on-one assistance, PCC users can attend different types of classes to learn both technological and non-technological skills. Some users attended classes about basic computing skills, hoping to learn how to type, how to use a browser, and how to use Word, Excel, and PowerPoint. These classes are offered by some of the PCCs, including Government Service Centers, Employment Centers, Literacy Centers, residence centers, and libraries. Others attend non-technological classes, mostly including language training (especially ESL) and GED classes. The types of classes the interviewed users attended are categorized in the following table.

Computer and Internet Classes	Non-technological Classes
Typing	Language Training (ESL)
Word, Excel, and PowerPoint	GED
Internet Exploration	

Table 8: Class-based Training

Comparison of the Two Models Among Users

Comparing the two models in which the PCC users can gain both technological and non-technological support, we found that more than 55% of the users we interviewed and answered the questions regarding assistance and training were more likely to seek help from the one-on-one assistance model. This is probably because of the flexibility of this type of assistance, which can be completely tailored to the needs of the users. If a user only wanted to know how to attach a document in the email, he or she would not need to attend a class, for example.

Another reason for this reliance on informal one-on-one assistance might be that some sites only offer classes in the daytime. This excludes some users who have to work at that time from attending these classes, as mentioned by one user from Lockhart Public Library: "[They have training classes, such as] Microsoft Office Word, Excel and learning about the Internet. It is really excellent, but I have a full time job. If they had night classes I would have come." As for those (around 20%) who were more likely to attend classes, most were users of Government Service Centers, which offer a variety of

classes both in the daytime and at night from basic computer classes to specific program study such as GED and ESL.

Users who did not participate in the formal training sessions tended to ask questions more related to job applications, job availability, resume writing, educational programs and school-work. Their computer and Internet skills were usually at the intermediate and knowledgeable levels. For example, a user from DeWitty Center stated, "I wouldn't say I know everything [about computers]. I know just enough to get me by...Some of the questions I ask is if a job has some health benefits." Another user from Lockhart Public Library mentioned:

> Sometimes when I have questions, I ask the librarians and they help me out. 'What questions?' If I have a question about my school-work, they are more than willing to help. […] It will be [only] related to my studies. 'So it is not about computers, sort of how to access and how to download. Then, how would you describe your computer skills?' Very knowledgeable.

Several users needed this kind of one-on-one to apply for a job, either by filling out an online application or writing a resume. As noted by one user from the DeWitty Center, "I ask [staff] everything from how to get into email to having templates for business cards…Not just related to computers, but things to help me get a job."

Therefore, we can conclude that PCC users often need help not only for computer and Internet use but also for other purposes, such as job hunting and education. This fact might be associated with their employment status. As shown in the figures below, more than half of the users we interviewed are not employed and are still looking for a job. Furthermore, quite a large number of the users we interviewed tended to seek assistance more from this one-on-one model, although there were usually only one or two trainers in

this position per site based on our observation and interviews with staff. Thus, more trainers may be needed for these roles. On the other hand, in order to increase the attendance of classes, some PCCs might consider offering classes at additional times, such as during evenings or on weekends.

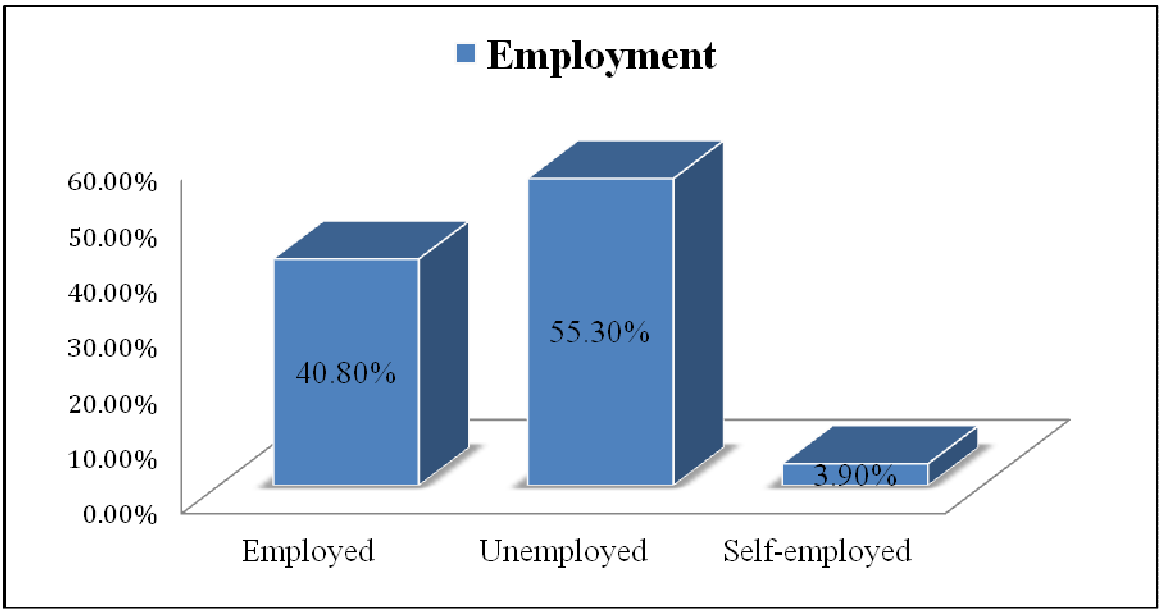

Figure 2: Employment Status of PCC Users

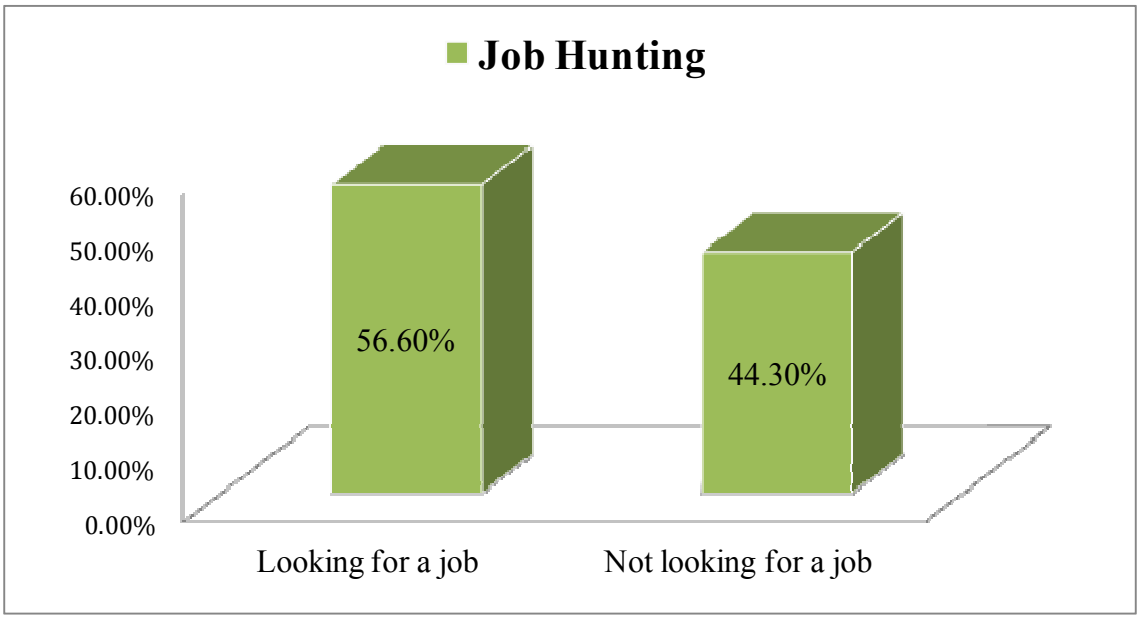

Figure 3: Job Hunting Status of PCC Users

Assistance from Users

Compared to the help obtained from trainers/staff, the help that the PCC users could get from other users was limited. Some users interacted occasionally with others, asking small questions about computer use. One user from Goodwill Community Center claimed that the site did not have a specific trainer, so users there typically helped each other out when they had problems with computer use. Another user from Haven for Hope Residence Center claimed that other users shared job resources with him, and that he had helped other users out with their minor computer questions. He gave a recent example of this: "This user asked me what the date was, and I told him that if he pointed his mouse at the monitor in the right hand corner at the bottom, he would be able to see the time in the computer's clock and also see the calendar."

Quote a large number of users we interviewed would prefer to ask trainers/staff for help as opposed to asking other users. These individuals believed that other users were busy with their own tasks, making interrupting them inappropriate. A user from DeWitty Center stated, "I would really try not to do that [asking for help from other users instead of trainers]. Everybody is busy doing their own things. I would rather speak to the staff…You know how quiet it is here, so obviously you don't want to be the one to start talking." Thus, most of the help the PCC users could obtain was from trainers and staff rather than their fellow PCC users.

Improvement of Skills

After coming to the PCCs we investigated, a lot of the users we interviewed claimed that their computer and Internet skills and/or job hunting skills were improved. The users with low digital literacy levels mostly claimed that their own computer and Internet skills had improved after coming to the PCCs. Before coming to the centers, many had very limited experience with these technologies, and some even claimed computers were something completely new for them. After visit a PCC, they at least knew many computer and Internet basics, such as copying and pasting, opening and saving files, typing, using a search engine, and downloading materials onto a USB drive.

Some users reported learning higher level information processing and Internet communication skills, such as using Word to write a resume, emailing, using Facebook to communicate with others, and so on. For example, a user from Goodwill Community Center was an extreme beginner, and learned how to use the computer from the very basics of turning the computer on. Since attending the PCC, he had "mastered" sharing

information and saving it into various places within the computer. He continued to say that he was "graduating toward being able to use the computer quickly." Another user from Denver Harbor Center improved her digital literacy skills to a large extent by attending computer classes in the center, saying "I have learned how to save documents. I know how to use a USB drive and I know how to open the files. I know the basics now. I also know the shortcuts [of Microsoft Office Word]." Finally, a user from Trinity Center also reported substantial improvement in his computing skills:

> I have learned how to copy and paste, how to check my spellings, [and] what windows to click to check that. And I have learned how to look up other resources, [and] how to get to the human resources place I saw on the map. Also [as for] the mail that I get from human resource places, I now answer them back on email.

Some of these users at lower digital literacy levels also improved their skills related to job hunting, such as filling out a job application, looking for job information either online or offline, writing a professional resume, and so on. These skills were critically important to them, as many of these individuals were unemployed and/or currently looking for a new job. A user from Trinity stated that she now could "go job searching on craigslist a lot" and "using it for employment and [her] email." Meanwhile, some users at higher digital literacy levels reported the improvement of job-seeking skills rather than more general digital literacy-related skills.

The Outside

The Built environment

The built environment characterizes more than the physical architecture and structural design of the sites. It embodies places and spaces created or modified by people

including buildings, parks, and transportation systems, which facilitate healthy, organic human interaction. To positively illustrate this concept in practice, here are a couple examples. One senior user at Bastrop library described how he began using the library: “Well, it impressed me that we had a lot of teenagers at the computers. And that they would come here…and after school they would pop in here so they were pretty much always occupied. And I was pleased with that." Another user at Lockhart Library said "My kids like it here a lot. I am pretty much busy on the computer, but I have met friends here and we say to each other hey we are at the library and my kids love coming here because they meet all kinds of other kids here. I think there is a lot of interaction between residents happening here at the library." Both examples demonstrate how the public libraries in our analysis generally established a positive built environment.

However, we found that other sites struggled to create this positive built environment, at least from an outsider’s perspective. For example, this quote comes from a user at the Arch: "I remember when I first walked up to the Arch, I was scared [intimidated]…I didn't want to go inside. You have all these guys just standing outside, doing their drug deals or just standing around doing nothing. Yet on the inside there is the Austin Free Net room and counselors you can talk to…but people choose not to."

Social Context of the Sites

Rural Sites

We found that rural library sites typically serve as important social hubs for the rural community. Because rural libraries are embedded in their communities, many residents have grown up visiting their libraries for various reasons through the years.

Urban sites

On the whole, cities present limited choices about where to go and what to do for the homeless and the ex-offender population. Several users suggested that PCCs in these urban areas are a place for solitude among these neglected populations. Users also suggested that the PCC was a "safe" place that welcomes the low income/homeless/ex-offender population. To illustrate, when we asked one user at Mission Milby whether or not they would still come to the computer center if someone dropped off Internet access and a computer at their home, the user said "probably, because of the environment...it's drug free, anti-violence, it's [a] peaceful place."

Transportation: How users get to the sites

Rural Sites

On the whole, we found that transportation is a major barrier to access for rural populations without access to adequate transport. The average rural user walks or drives to the public library. For example, a PCC user at Bastrop said "I live around 4 miles away. I generally drive to get to the library."

Urban sites

Urban PCC users heavily depend on public transport. We find that urban user's relative access to transportation and the quality of the public transportation greatly impacts the frequency and duration of their PCC visits. As a user at Dewitty stated, "I come on and off. I am on the bus a lot so it takes me a while to get here. I have to ride for a long time." When asked whether it was a long commute to the PCC, the user responded "Well, not really. I just have a lot to do. With the job search and all. I am on the bus…have to switch buses, so it just takes me a long time to finish everything and get here."

The Inside

We found that hours of operation affect the volume of traffic and how much the computers actually get used at the sites. Some users wished the PCCs operated more on weekends and during late evening hours. For example, one respondent reporting on user behavior at Bulverde library said the user "visits the library on average three days a week but wants to visit more…she is unable to because the library closes early on Fridays and shuts off the computers earlier as a result."

Another barrier to the PCC computer use was time limits at some sites. Users expressed this concern especially at urban sites, where the combination of limited space and high traffic makes it difficult for users to complete their objective. For example, a user at Haven for Hope stated "You get stuck sometimes when you are filling out an application and you have to stop doing what you are doing because of a time limit. Here you can work at your own pace." This demonstrates how shorter time limits are not conducive to job searches and online applications.

Motivation to Visit Sites

Rural Users

Rural users reported several reasons why they visited the PCC. The common responses included: limited/no Internet access at home, limited mobile Internet at home, no home access for desktops/laptop/tablets, desktops and faster broadband at the library, access to help from trainers, computer training classes, and that their children want to use the computer.

Urban Users

We found that the motivations for visiting PCCs among urban users were somewhat different. The most common responses included: seek help from trainers, conduct job-searches, utilize printing facilities, attend computer/GED training classes, and general Internet use, such as social media, entertainment, gaming, videos. Moreover, because urban sites tend to be embedded in larger multi-service centers, many of the urban users visit the sites to receive other resources offered at the site and simply drop in the computer center before or after their alternative purpose. The most common resources include: free meals, access to showers, mailboxes, telephones, faith and fellowship, help with housing, counseling, mailboxes, paperwork for certificates, and free bus passes.

Alternatives

Rural Users

Rural users have few alternative options for Internet access outside the PCC and their home, especially if they cannot afford a computer and the broadband Internet package. Some users mentioned that Starbucks, Schlotzky's, and McDonald's offer Internet access. However, these commercial businesses do not provide computers, training, or troubleshooting support, and the users must purchase something at the business in order to access the Internet. Thus, the alternative options require that rural users own an Internet-enabled device, have some degree of proficiency in computer/Internet use, and impose some minimal cost to the user for each visit.

Urban Users

Urban users can also access the Internet outside the PCC through commercial businesses like Starbucks, Schlotzky's, and McDonald's. These alternative options come with the same restrictions listed above. Some urban users have a couple of additional

options for computer access, Internet, and limited IT support without payment including libraries and Texas Workforce.

Chapter 7: Conclusions

Through the large infusion of funds provided by the Broadband Technology Opportunities Program (BTOP) to Texas Connects Coalition (TXC2), the public computing centers (PCCs) are reaching diverse populations. The PCCs come in many shapes and sizes and each is tailored to meet a specific segment of the population with specific needs. The public computers positioned in libraries serve a broad community base and directly address challenges to access and insufficient broadband speeds that plague large segments of the rural, underserved population. Some PCCs help meet the needs of the unemployed and homeless. Other PCCs are embedded in larger service distribution centers, where Internet access is one of many services utilized by visitors. It can be said that other community services such as WIC program available at the places where some PCCs are located were popular with low-income families. It would be desirable for operators of each service to find a way to work in a more synergistic manner. It is also equally important to maximize synergy between PCCs and nonprofit organizations. For instance, Austin Area Urban League, Multicultural Refugee Coalition, and Child Inc. are serving heterogeneous user needs. Seeking more aggressive collaboration with these organizations can be an effective way to attract new potential beneficiaries.

For large segments of the population served by these PCCs, spaces and hardware alone are not sufficient to meet the population's needs. Many of the PCCs in the study supplemented the technological hardware with computer training and classes taught by

dedicated and patient trainers. Users highly value the one-on-one attention given to them by PCC trainers. Trainers serve users with highly varied preliminary computer knowledge and a wide range of technology-related needs. Moreover, PCC users seem highly interested in social media, which appears to play an important role in maintaining clients' engagement and enhancing computer familiarity.

Although we could not interview persons under 18 years of ages, nearly every team member who went into the field to conduct interviews observed that the PCCs were heavily used by children and adolescents. As a fortunate but unintended consequence, our observations suggest that the funds allocated towards PCCs likely had a positive impact on the youth in these diverse communities.

At the organizational level, most the PCCs are embedded within the larger resource/sharing system of nonprofit ecosystems. The PCCs have diverse strategies for supporting the diverse populations and service needs, some leverage resources in other organizations within large non-profit ecosystem more than others. At least in part, this is because some centers and individuals within the centers are more eager to buy into the idea that they are apart of a larger ecosystem and forge closer relationships that might help better serve their users. In addition, like the findings from user reports, we found the trainers and staff to be extremely passionate and dedicated to serving the user populations and their varied service needs.

Staff members at PCCs suggest that they rely almost exclusively on the "word-of-mouth" marketing to get more users in the sites. Few PCCs had additional mechanisms for outreach, despite the fact that many of computers inside the PCC remain utilized for

large portions of the day. Moreover, none of the PCCs have strategies for operationalizing this "word-of-mouth" marketing in attempt to quantify how well it was working or developing strategies for encouraging more users to get the word out.

Lastly, we found inconclusive evidence about the importance of mobile technology and wireless Internet in these PCCs. More recently, staff and trainers report increased use of Internet-enabled mobile devices, particularly among younger users in PCCs located in urban areas. However, few users reported owning these devices, especially older users visiting PCCs in rural areas. Trainers point out the cost and benefits of a mobile-focused strategy vs. a more traditional brick-and-mortar desktop strategy.

Recommendations

Based on the conclusions of the nine-month study of public computer centers in Texas, this report recommends the following:

1. Metrics and Accountability
    i. This study recommends that public computer centers require additional information on sign-in sheets. Public computer sites have some form of metric to document user visits. These metrics are commonly in the form of sign-in sheets, which users enter their name and purpose for the facility. These sign in sheets do not account for repeat users, referrals. To obtain better measurements in alignment with the requirements outlined in the BTOP program,

public computer centers can more accurately report data by including additional information on sign-in sheets.

ii. Second, this study recommends that public computer centers install, report and draw patterns from Yusadge data. Fortunately, the software Yusadge is already installed on computers in the study sample. However, this study found that Yusadge data were not standardized across sites. Some Yusadge data across sites measured use in 30, 45 and 60 minute intervals. These different measurements impair the reliability of the analysis.

2. Redistribute Resources

This study found that public computer centers overused computers while other sites underused computers. Some public computer centers possessed unused computers. At other sites, all computers were in use by users. The rebalance of computers across sites will reduce the overuse of computers in other public computer centers. The rebalance of computers across sites requires institutional coordination across centers.

3. Attract Users

The variability of public computer centers across sites attracts different users. As a result, this requires different recruitment strategies. The no one-size-fits-all model for increasing the volume of users is insufficient.

4. Broaden legitimate use for broadband

    i. The objective of the BTOP project is to drive economic growth by way of stimulating job opportunities in communities that underutilize broadband by providing free broadband access in anchor institutions. These anchor institutions in large part limit the use of broadband activity to employment websites. However, employment opportunities are not only limited to employment websites. Such opportunities may surface from social media, such as on Facebook or electronic communities like craigslist or Myspace. By limiting job searches to only employment web sites, public computer centers limit the opportunity for job seekers to fully exploit broadband capacity for employment opportunities.

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