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Technology Outreach Programs: Their Impact on Middle-School Students and Their Families from Underserved Communities

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Technology Outreach Programs: Their Impact on Middle-School Students and Their Families from Underserved Communities

by

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Dedication

To my wife, kids, parents, sister and her family

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"Everyone who's ever taken a shower has an idea. It's the person who gets out of the shower, dries off and does something about it who makes a difference."

-- Nolan Bushnell

It is my honor to thank all who contributed to this dissertation. I express my gratitude to my dedicated advisor, committee members, participants, friends, and family for their encouragement, support, and guidance. While these are merely words in this space which express my thanks, it is my hope that readers can read between the lines and find my feelings of heartfelt gratitude to everyone who helped me complete this journey.

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Technology Outreach Programs: Their Impact on Middle-School Students and Their Families from Underserved Communities

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The goal of this study is to provide a better understanding of the impact of outreach programs designed to impart technology skills to middle-school students from underserved communities, on both participants and their families. An outreach program, called Hi-Tec CompNow, was chosen for this study. This program was conducted as an after-school program for middle-school students from underserved communities in central Texas wherein participants learn computer hardware and software skills during a ten-week period. The study utilized (a) an interpretive analysis of the data generated from a questionnaire administered at the beginning and end of the program to obtain participants' computer beliefs, (b) program observations recorded by the researcher during program sessions, and (c) interviews conducted by the researcher with participants and their families after program completion.

Results of the study showed that the majority of participants experienced some increase in their CSE beliefs at the end of the program, but the changes were not statistically significant. The study further illustrated that participants interviewed by the

researcher expressed increased confidence in computers, spent more time on home computers, and were able to resolve computer issues in their homes. Parents were pleased with the program as well and generally expressed increased confidence in their children's computer skills.

The study identified some of the program attributes which seemed to have led to enhanced CSE beliefs in most participants. These included hands-on experiences and teacher demonstrations of computer skills. In addition, the study found that student encouragement through family support and commitment had a positive impact on participants' CSE beliefs, while negative family input had a negative impact. Lack of culturally-responsive learning content, participants' lack of use of the dial-up Internet service provided cost-free for a year, and perceptions that the computers provided by the program were outdated and thus not fully functional were factors which seemed to have undermined the program's impact on digital equity. Additionally, the program provided software which focused on document creation, spreadsheet-based analysis, and presentations. However, the study also revealed that most participants utilized home computers for more "recreational" purposes, e.g. playing games, and playing and/or editing music, games, and videos.

The study suggests that well-intentioned outreach programs such as Hi-Tec CompNow are making laudable efforts to bridge the digital divide. However, they need to reinvent themselves to ensure underserved populations do not get left behind in a digital world that has moved beyond the desktop computer. To enhance the digital literacy of the underserved, digital equity programs must provide opportunities to build their skills in multimedia, mobile media and online participation in addition to fostering access to newer computers of good quality with high-speed and wireless Internet.

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Chapter 1: Introduction

This dissertation is the result of a qualitative study aimed at providing a better understanding of the impact of outreach programs designed to impart technology skills to middle-school students from underserved communities, on participants and their families. An outreach program, called Hi-Tec CompNow, was chosen for this study – this program was conducted as an after-school program for middle school students from underserved communities in central Texas wherein participants learned computer hardware and software skills during a ten-week period and took home a refurbished desktop computer with a free one-year Internet connection at the end of the program. The study utilized an interpretive analysis of the data generated from a questionnaire administered at the beginning and end of the program to obtain participants' computer beliefs, observations of program recorded by the researcher during the program, and interviews conducted by the researcher with participants and their families after program completion. This chapter presents the background and significance of this study, an overview of the program chosen for the study, the statement of problem, the research methodology, study limitations, and definitions of terms.

BACKGROUND AND SIGNIFICANCE OF THE STUDY

In this section, we will take a look at some of the key concepts relevant to the study and review the efforts undertaken in this regard in terms of policy, programs and collaborative efforts. Subsequently, we will take a closer look at literature that examines the program outcomes including self-efficacy and technology skills development. We will finally conclude this section with a review of existing literature on understanding the impact of these programs on K12 students.

The advent of micro-computers led to the increasing interest in using them for instructional purposes during the early 1980s (Reiser, 2001). They were relatively inexpensive, compact enough for desktop use and could perform most of the functions performed by larger computers. Reiser explained that until the mid-1990s, desktop computers were primarily used for drill and practice at the elementary level and used for teaching computer-related skills such as word processing at the secondary level. The advent of the Internet led to an increasing interest in using Internet-based technologies for instruction. A survey conducted by Bassi and Van Buren (1999) indicated that percentage of percentage of training delivered via such new technologies as CD-ROM, intranets and the Internet rose from less than 6% in 1996 to more than 9% in 1997. By 2005, 97% of public schools in the US had broadband connections to the Internet and the ratio of students to instructional computers was 3.8 to 1 (Wells, 2005).

Digital Divide

Technology proficiency has become an economic necessity and the need for K12 students to know and use computer technology has increased over the last decade. Additionally, technology skills coupled with a high school education have become minimum requirements for entry into the labor market. Socio-economic factors and gender continue to create barriers to technology proficiency amongst the underserved and economically disadvantaged members of society. The terms “digital equity” and “digital divide” have been used to describe and understand this phenomenon.

Davis et al. (2007) defined “digital equity” as equal access and opportunity to use digital tools, resources, and services to increase digital knowledge, awareness, and skills. Solomon (2002) posited that while the problem of digital access is on its way to being solved, reaching those populations of students out of the educational mainstream still

remains a challenge. Carvin (2006) explained that the digital divide also exists along the lines of race and education levels, in addition to income. His research concluded that Caucasian and Asian-American households were more likely to be online than African-American households, which in turn were more likely to be wired than Latino households. Carvin's study revealed disparities in online access based on household income and education level as well. Warschauer (2010) found that the type of digital divide pertaining to the inequitable access for youth in the US to computers and the Internet has been largely resolved as the youth are able to access them either at their home or at a public location such as their school or a public library nearby. However, he found that a new type of digital divide exists wherein the ability to use new digital media for communication, analysis of information and working with others is not prevalent amongst youth in an equitable manner.

Progress towards equitable technology access and use has been a goal for policy makers and researchers. Resta and McLaughlin (2003) suggested that several programs have been developed in the US with the understanding that while the use of technology is increasingly widespread, an equitable distribution of this technology between the various groups in society continues to be a challenge. Salpeter (2006) described several programs that place laptops or other technology in the hands of all students in a school (or across an entire state) for 24/7 access with the goal of bridging the digital divide. These programs include state initiatives such as Maine's "Learning Technology" program (www.state.me.us/ mite) that involves every 7th and 8th grade student and teacher in the state and Michigan's "Freedom to Learn" program (wireless.mivu.org), which establishes 1:1 laptop initiatives in selected low-income communities.

Refurbished computers have also been used by outreach programs to enhance equitable access to computer technology. DePillis (2005) described a program in which

refurbished computers were provided to schools and orphanages in developing areas of the world and high school students in a technology academy at their high-school in Seattle taught technology skills to participants. DePillis found that the students in the academy became familiar with how the machine actually works, not just what it does. He felt that this detailed understanding gave academy students technical expertise that even their Internet-addicted friends couldn't claim.

Efforts to Bridge the Digital Divide

In 2000, the U.S. Department of Commerce also found that Internet access was significantly dependent on household income and minority status (Crawford and Toyama, 2002). In an attempt to bridge this wide disparity of resources, more than 2,000 community technology centers (CTCs) have opened in the United States in the last decade, specifically to provide better access to technology in economically disadvantaged communities. Consequently, low-income Americans and ethnic minorities with the lowest access to technology are among those most widely served at CTCs (Chow et al., 2000). CTCs are also often embedded in existing organizations, such as an After-school (AS) program, church, library, or a community-based organization (i.e., Boys and Girls Clubs, YMCA).

Several collaborative efforts between for-profits, non-profits and academic institutions have been undertaken over the years to bridge the digital divide. Researchers have found that the establishment of strong and effective relationships between schools and businesses can improve incentives for students who would like to start working after completing school (Rosenbaum, 1989). According to Bill and Motz (2004), there is a union of institutional forces to accomplish complex societal changes by finding common ground in an era of partnering and shared social responsibility. Collaborating institutions

can create project-based learning activities that are aligned with their mission and also linked to the school curriculum. According to Harvard Family Research Project (as cited in Harvard Family Research Project, n.d.), programs are more likely to exhibit high quality when key stakeholders including family, community organizations and schools create, develop and leverage partnerships between each other. They cited the example of Boys & Girls Club, whose programs benefited from partnerships with schools, probation and police officers, and community-based providers.

Computer and Information Technology companies have also not lagged behind in this endeavor. Waters (2007) highlighted some of the programs and suggested that these programs were created to expose users to the tools and technologies they produce and also increase the pool of workers who would be familiar with their tools and technologies. Some of the programs mentioned by Waters include those run by The Bill and Melinda Gates Foundation for imparting website development skills, developing an online learning community for primary and secondary school students and encouraging 21st Century learning skills development. Other initiatives developed by Intel Corporation and Sun Microsystems have also been mentioned in his work.

Research has clearly shown that additional factors promoting the digital divide between the haves and the have-nots still exist. Economic disparities play a key role in the development of technology skills - Solomon (2002) suggested that low-income groups more often use computers for lower-order skills, such as drill and practice in mathematics, which can actually have a negative impact on achievement. Meanwhile economically advantaged students are getting more opportunities to use technology for higher-order activities, which are positively related to academic performance. Solomon (2002) also highlighted areas of concern to include the quality of hardware and connections, kind of technology use by students, quality of teachers and leadership. Resta

and McLaughlin (2003) identified other factors that play a key role in bridging the digital divide to include: access to technology, meaningful, high-quality and culturally-responsive content, trained educators and leadership. Gay (2002) highlighted the significance of using symbolic curriculum and societal curriculum as ways of providing cultural significance within the learning content. Gay explained that symbolic curriculum refers to images, symbols, icons, mottoes, awards, celebrations, and other artifacts that are used to teach students knowledge, skills, morals, and values - convey important information, values, and actions about ethnic and cultural diversity. Societal curriculum refers to affordances incorporated in the curriculum for critical analysis about knowledge, ideas, and impressions about ethnic groups that are portrayed in the mass media. Judge et al. (2006) examined the progress made in this area from the perspective of children's first four years in school. They found that access to, and use of, a home computer, the presence of a computer area in classrooms, frequent use of the Internet, proficiency in computer use, and low-poverty school status were factors that need to be considered for promoting digital equity.

Several attempts have been made to take these factors into consideration and bridge the digital divide in K12 schools. Information Literacy, Technology Literacy, Technology Proficiency, and Technology Fluency have been some of the goals stated for these programs. Kong (2008) defined Information Literacy as the process of capacity building whereby a learner develops the capacity to work independently and socially, and participates in, benefits from and contributes to the information society and the wider global community. Resnick and Rusk (1996) defined "Technology Fluency" as the end result of a process in which students gain knowledge of technology as they learn with and through computers in a community. Crawford and Toyama (2002) defined "Technology Literacy" as the product of a process in which proficiency development is considered a

checklist of discrete skills separate from a larger activity. They also considered "Technology Proficiency" as the outcome of a learning process in which students acquire the technology-related skills and knowledge they need in order to participate successfully in the 21st century workforce and become autonomous, life-long learners. Jenkins et al. (2006) suggested that "media literacy" should be included as a goal for programs focused on bridging the digital divide. They explained that students not only need access to technology and the skills to use them, but should also be able to understand how media shapes their perceptions of the world and should be prepared to be ethical during their participation in online communities.

Computer Self-efficacy

Researchers have considered the role of self-efficacy in enabling learners to be members of the 21st century workforce and have undertaken research efforts to understand whether computer technology can promote self-efficacy amongst its participants. Bandura (1997) defined self-efficacy as individuals' confidence in their ability to organize and execute a given course of action to solve a problem or a task. He regarded the belief in self-efficacy as the foundation of human motivation, well-being and personal accomplishments and also suggested that efficacy expectations determine the levels of effort and persistence that individuals put into their learning activities.

Andrews et al. (2005) examined whether occupational self-efficacy (the belief that one can succeed in a particular job) was promoted amongst participants in their research study that looked at the impact of integrating computer technology on sections of the society that did not have sufficient skills and access to technology. Their study was inconclusive but felt that the events of September 11, 2001 might have had some effect on the study. Other researchers have further examined the relationship between

self-efficacy and technology use. Liu et al. (2006) examined the effect of computer-enhanced problem-based learning environment on middle school students and focused on the subject of science. They found that this environment increased the students' science achievements and their self-efficacy for learning science and also suggested that self-efficacy could predict their academic achievement as well. In a study of 340 Greek elementary school boys and girls, Vekiri (2008) found that parental support and to a lesser extent, peer support, strongly affected boys' and girls' computer self-efficacy and value beliefs and found that the level of computer access was not related to their motivation to learn computer skills. Hsu et al. (2006) surveyed 235 students from a vocational college and technology university to study computer self-efficacy determinants from the perspective of participant internal learning motivations (interest, trend and employment) and external learning environments (home and school). They found that computer use and interest had a direct and positive impact on their computer self-efficacy while the home environment and employment factors had an indirect, but positive, impact on computer self-efficacy. While the study participants indicated that they were not satisfied with their school learning environment, it did not affect their sense of computer self-efficacy.

Some researchers have investigated whether K12 outreach programs can promote self-efficacy amongst its participants and have attempted to develop research instruments for the purpose. Turner and Lapan (2005) evaluated an intervention program to increase career-related self-efficacy amongst middle-school students and found that young adolescents' career-related self-efficacy and interests in non-traditional careers can be increased through their participation in computer assisted career intervention and group exploration activities. Riggs and Enoch (1993) developed a tool, known as Microcomputer Beliefs Inventory (MBI) to measure the self-efficacy and outcome

expectancy beliefs of middle school students toward computers. After conducting a study with the instrument with a sample of 269 students, they concluded that that the MBI was a valid and reliable instrument for investigating middle school students' beliefs about computers. Torkzadeh et al. (2006) developed a contingency model of computer and Internet self-efficacy and examined the model in a university environment. They found that training significantly improved computer and Internet self-efficacy and the interaction between attitude and anxiety towards computers significantly affected computer self-efficacy.

Bandura (1986) advocated that training to increase students' self-efficacy might focus on improving students' actual computer skills through modeling, successful hands-on experiences, and positive verbal feedback. Some researchers have explored outreach programs from the perspective of modeling and learning that can occur from peers. For instance, Edwards (1997) presented new technology to children as a completely new activity focused on design and construction. Computer activity was presented within a social setting specifically designed to utilize peers as well as adult experts as sources of support for the children's learning. She found that peer teachers were utilized as experts by the other students and benefited from this experience. It would be interesting to explore whether K12 outreach programs include the attributes suggested by Bandura in their program and whether they promote self-efficacy amongst its participants.

It follows from the above discussion that self-efficacy can be a desirable goal of programs that promote the learning of technology skills. This section now examines the efforts undertaken by researchers to understand the learning goals and methodologies used for K12 outreach programs and will subsequently discuss the efforts undertaken by researchers to understand the impact of these programs.

Outreach Programs and Learning

Andrews et al. (2005) rightly indicated that much of the early digital divide research was based on solutions developed in conjunction with community technology centers. Most CTCs support only the most basic computer activities (such as word processing, email, and Internet browsing), so participants do not acquire technological fluency. After-school (AS) programs have been developed to typically focus on school-age children, their educational development and enrichment activities, as they relate to student achievement. Many after-school centers (which, unlike CTCs, focus exclusively on youth) have begun to introduce computers, but they too tend to offer only introductory computer activities, along with educational games (Vasquez & Duran, 2000; Zhao, Mishra, & Girod, 2000). Warschauer (2004) suggested that many outreach programs enable the access of new technologies to members of low-income and minority communities in such a way that neglects to take the local context into consideration, and are often presented in such ways that reinforce rote learning activities rather than cognitively demanding activities. However, a small subset of after-school centers and CTCs, such as those in the Computer Clubhouse network, explicitly focus on the development of technological fluency, moving beyond basic computer skills and helping youth learn to design, create, and invent with new technologies (Resnick et al., 1998).

Not only are schools beginning to realize the added value of K12 outreach programs, but these programs are interested in providing students with skills that will enable them to be successful (Noam, 2001). Many of these programs have focused on developing curriculum that promotes hands-on, project-based learning in a situated context and enables the learners to learn from experts by interacting with them, modeling experts' behavior and obtaining feedback through a process of legitimate participation in authentic tasks. According to Solomon (2002), students learn best when they're actively

engaged, and technology can motivate and help them use information and resources meaningfully. When students create and share reports, Web pages, or digital presentations that require higher-order skills, they are empowered as learners and thinkers. Wenglinsky (2005) analyzed results from the National Assessment of Educational Progress (NAEP) database which contains the results of NAEPs administered every year or two to nationally representative samples of 4th, 8th, and 12th graders. He found that the quality of computer work was more important than the quantity and that students could receive a substantial benefit, no benefit, or even negative consequences from working with computers in the classroom, depending on how their teachers chose to use technology. Dobosenski (2001) studied ways for increasing technology skills and attitudes towards computers amongst girls and found that teaching hardware skills helped them learn technology language and goal-oriented computer games that involve real-life problem solving and interesting characters promoted computer fluency.

To incorporate authentic experiences in learning, many outreach programs have incorporated the cognitive apprenticeship methodology that is drawn from the socio-constructivist theory of learning. This learning theory highlights the importance of socio-cultural context in learning while the cognitive apprenticeship methodology stresses the need to place authentic activities in a social context that involves students, teachers and mentors to foster engaged learning amongst participants.

Evaluation of Outreach Programs

Thus far, we have examined researchers' efforts to understand the learning goals and methodologies used by K12 outreach programs. Let us now briefly review existing literature on efforts to evaluate these programs. DeAngelis (2001) indicated that "there is

no consensus on what makes for a good after-school program". According to Bill and Motz (2004), successful CTCs and AS programs reflect the unique needs of its community. Consequently, the best way to view and understand a successful AS program is to employ a holistic view and flesh out the context in which the program functions and affects the child and community members. It has also been shown that programs that service teens in a holistic manner, integrating technology skills with psychological, emotional, or social development have results that are difficult to capture in traditional outcomes-based research and evaluations (Teens and Technology Roundtable, 2004).

Many outreach programs aim to increase the pool of children from underserved/minority communities who enter engineering and science programs (Hanesian and Perna, 1999). Reviews of such programs have shown that the programs give students exposure to independent learning, collaborative activities, and hands-on experience. The assessment of K12 outreach programs that focus on development of students' skills in science, engineering and technology has mostly focused on obtaining survey-based feedback from participants. Poole, et al. (1999) developed several assessment tools including participant feedback, long-term outcomes assessment of teachers and embedded assessment that was used in the classroom. These tools were intended to assess survey-based responses for determining the short-term program impact of such programs.

Denner and Werner (2007) conducted a qualitative study of an AS program called "Girls Creating Games" in central California wherein participants designed and programmed computer games. They showed that girls were able to work in pairs, monitor and assess their problem solving activities and produce software. They were also able to develop some insights into ways in which enhanced problem solving skills could

be developed amongst girls. Reisner, et al. (2007) conducted a longitudinal study of 35 high school AS programs to explore ways in which they contribute to certain desired psychological, social and academic outcomes for disadvantaged youth. They observed that participants were able to improve their work habits and conduct after the program and academically fared significantly better than their peers who were unsupervised after-school hours. Jenner and Jenner (2007) evaluated several 21st Century Learning Centers in Louisiana using a quasi-experimental design and found that the program was having a positive academic impact on participants who attended the program for more than 30 days. Their attendance record also has a direct impact on their academic achievement.

Salminen-Karlsson (2007) conducted an ethnographic study at an after-school technology education center in Sweden that provided technology education for students aged 6-16 years. The researcher examined the effects of the use of single-sex groups in increasing the interest of girls and boys in technical activities and found that the groupings alone do not break down gender barriers. Field notes and lengthy interviews with different members of the center's staff were used for the study. Members of the Harvard Family Research Project (2008) conducted two-year longitudinal study on the effects of participation in AS programs that they considered to be of high quality. After reviewing 35 such programs, the researchers found that the participants demonstrated significant gains in standardized math test scores when compared to their peers who were regularly unsupervised after-school. They also found that these programs had a positive impact on the participants' school grades, attendance and their aspirations in general. Subrahmanyam et al. (2000) explored the impact of one computer-based after-school program called "The Fifth Dimension" and found that children who participated in the program had greater advances in reading, mathematics, computer knowledge, following

directions, and grammar and had higher scores on school achievement tests, compared with children who did not participate.

Summary

In conclusion, this researcher's review of the academic literature found that bridging the digital divide is not just about providing access to computer technology but is about the equitable distribution of technology coupled with equitable opportunities to learn using the technology. Researchers have found that providing new or refurbished computers to students needs to be blended with authentic tasks geared towards technology skills development. Researchers have also established that computer self-efficacy and Internet self-efficacy can be promoted through training. While a number of programs exist for K12 students and technology education, very few efforts have been undertaken to assess the impact of AS programs that teach technology skills, on the learners and their families. Due to the diverse nature of the programs and differences in the situated context of these programs, qualitative and ethnographic methods can be effective research methods for increasing our understanding of the impact of these programs. The researcher selected an after-school program called Hi-Tec CompNow to explore the issues highlighted thus far that provides low-income or underserved middle school students the opportunity to earn a refurbished home computer and learn technology skills to better prepare them for opportunities in today's technology driven world. More details about the program are provided in Chapter 3.

THE PROBLEM STATEMENT

The objective of this study was to develop a greater understanding of the impact of after-school programs that impart technology skills on students and their families and address the following research questions:

1. How did participation in the program affect students' self-efficacy beliefs in their computer skills?
2. How did the change in computer self-efficacy beliefs in participants impact their usage of computers and Internet connectivity at their homes?
3. How did the introduction of a computer and Internet connectivity into the participants' homes impact them and their families?

OVERVIEW OF THE RESEARCH METHODOLOGY

The subjects for this study were students at Central Texas Middle School (CTMS) who attended the Spring 2009 edition of the Hi-Tec CompNow program. Additional participants in this study included the parent(s) or guardian(s) of the program participants. As part of the qualitative research process, the researcher made field notes about the progress made by participants during the program and their experiences. Additionally, the researcher administered a questionnaire at the beginning and end of the program to help understand the impact of the program on participants' self-efficacy beliefs about their computer skills. Finally, the researcher conducted interviews with the participants and their parent(s) or guardian(s) at their home and used a set of guiding questions to understand their perceptions about the impact of the program. The data for the qualitative analysis came from multiple sources, including participant responses to the computer self-efficacy questionnaire, reflective notes written by program participants during the course of the program, field notes taken by the researcher while observing the program in action and interviews recorded by the researcher at the homes of participants and their families.

The constructionist paradigm informed the study from an epistemology perspective. A statistical analysis of the data generated from the questionnaire coupled

with a qualitative analysis of the remaining data was the author's methodology of choice. Socio-cognitive learning theories, literature discussing digital equity and factors affecting computer self-efficacy provided further guidance in the interpretation of the researcher's findings arising from the analysis of this data.

LIMITATIONS OF THE STUDY AND KEY DEFINITIONS

This section provides a brief explanation of the boundaries of this study and ways in which the findings might lack generalizability. Definitions that are particularly relevant to this study are also discussed in this section.

The researcher conducted the study on one instance of a nationwide program that focused on developing technology skills to middle school students from underserved communities. Consequently, the findings of this study are not generalizable to other programs that might be similar to the program being studied. Additionally, the sample size for the self-efficacy assessment was 12 participants. Therefore, the results of this effort cannot be generalized across programs of a similar nature or even across all the program instances. Finally, the findings will be interpretivist in nature that is based on the researcher's observations and analysis of data – the findings will thus be specific to this study. However, the researcher hopes that the findings will be useful to the research community in further understanding ways in which such after-school programs have an impact on participants and their families.

Some of the key definitions that are relevant to this study are as follows.

1. *After-school Program:* An outreach program that is conducted at the premises of a K-12 school after-school hours.
2. *Computer Self-efficacy:* Individuals' confidence in their ability to use computers for executing a given course of action and solve a problem or a task.

3. *Digital Divide:* The gap between people with effective access to digital and information technology and those with very limited/no access.
4. *Digital Equity:* Equal access and opportunity to digital tools, resources, and services to increase digital knowledge, awareness, and skills.
5. *Technology Skills:* Computer skills that students learn to use and apply in their lives.
6. *Limited Exposure to Computer Technology:* A family that either does not have a working computer at home currently or has never had a working computer at home in the past is considered to have limited exposure to computer technology.
7. *Outreach Program:* A program that is either funded or supported by a private organization to provide opportunities for K-12 students for skills development and/or additional education.
8. *Self-efficacy:* Individuals' confidence in their ability to organize and execute a given course of action to solve a problem or a task.
9. *Underserved Communities:* These are communities that have incomes below the poverty level, live in historically underserved areas and have limited exposure to computer technology.

KEY BENEFITS OF THE STUDY

This study is expected to provide an increased understanding of the following:

1. Impact of the program on the participants' computer self-efficacy perceptions.
2. Perceptions of the participants and their families on the usefulness of the program, computer and Internet connectivity
3. Impact of the program, computer and Internet connectivity on the participants' computer literacy, a key 21st century skill.

4. Impact of the program, computer and Internet connectivity on the participants' social role amongst their family and friends.
5. Impact of the program and change (if any) in computer self-efficacy perceptions on participants' computer usage.

Chapter 2: Literature Review

In this chapter, we will review the efforts undertaken by researchers to study outreach programs that focus on teaching technology skills to the underserved. We will review current literature that focuses on the aspects of learning, self-efficacy and collaboration in the context of outreach programs in the K12 sector and will highlight efforts programs that focus on middle school students. Subsequently, we will take a closer look at literature that examines current efforts to understand the impact of K12 outreach programs on participants' self-efficacy beliefs and technology skills development. We will finally conclude this chapter with a review of existing literature on understanding the impact of these programs on K12 students.

DIGITAL EQUITY AND COMPUTERS IN EDUCATION

Micro-computers that were as functional as larger computers arrived on the technology scene during the early 1980s. According to Reiser (2001), their low cost and smaller size (compared to the mainframes) resulted in their increased use as desktop computers in classrooms primarily for tasks such as drill-and-practice and word processing until the 1990s. He indicated that many computer programs for programmed instruction have failed due to factors such as poor quality, inadequate equipment and curriculum, and inadequately trained teachers. Later studies showed that the use of desktop computers as a supplement for conventional instruction in the classroom promoted cognitive processes of learning such as problem-solving and had a positive impact on children with low scores on standardized tests (Saettler, 2004). The rise of computer simulation and computer-assisted games has also enhanced the effectiveness of computer programs for instruction. The US Department of Education (USDE) conducted a study (Miners, 2007) to review several educational software products and determine

whether their use affected reading and math test scores. While the study found that the use of these products did not have a statistically significant effect on test scores, USDE is conducting an additional study to examine the effect of technology training for teachers on effective use of these products.

The convergence of diverse information technologies, such as computers, television, and satellites, in addition to the advent of the Internet led to an increasing interest in using Internet-based technologies for instruction. Bassi and Van Buren (1999) conducted a survey of more than 750 training industry companies and found that the percentage of training delivered via technologies such as CD-ROM, intranets and the Internet rose from less than 6% in 1996 to more than 9% in 1997. Another study conducted by Wells and Lewis (2006) found that 97% of public schools in the US had broadband connections to the Internet and the ratio of students to instructional computers was 3.8 to 1 by 2005. Additionally, they reported that 45% of public schools with Internet access used wireless connections in 2005. They prepared a report to present key findings from the 2005 Fast Response Survey System (FRSS) survey on Internet access in U.S. public schools and selected comparisons with data from previous FRSS Internet surveys. These surveys were conducted by National Center for Education Statistics (NCES). They also reported that the ratio of students to instructional computers with Internet access in public schools was 3.8 to 1 and was a major improvement from 1998 when the same ratio was 12.1 to 1.

Smith (2010) showed that 66% of the US population had a broadband connection at home in 2010 compared to 15% in 2003. Blumberg and Luke (2010) found that 24.5% of the US population had only wireless telephones and no landlines at their home in 2010 compared to 5% in 2003. With the increased use of computers and related technologies over the past decade, it has become imperative for K12 students to not only graduate

from high school but also become proficient in computers, Internet and digital media. However, students from underserved and economically disadvantaged members of society continue to face barriers due to gender and other socio-economic factors. Data released by the US Commerce Department found that Americans in lower-income and rural communities have slower Internet connections than the rest of the US population (Kang, 2011). Researchers, practitioners, administrators and policy makers in the education arena have made several attempts to understand and solve the problem of inequitable distribution of technology in general and instructional technology in particular. Terms such as "digital equity" and "digital divide" have been used in this connection and the next section discusses it in greater detail.

"Digital Equity" has been defined as the equal access and opportunity to digital tools, resources, and services for increasing digital knowledge, awareness, and skills that promotes a fair distribution of student needs and a comparable delivery of goods and services (Davis et al., 2007). Davis et al. also defined "digital divide" as the disconnect that occurs between those with access to technology and those without, while recognizing that myriad factors can have a direct impact on that inequity. Solomon (2002) examined data from an Educational Testing Service study of eighth graders and posited that while the problem of digital access is on its way to being solved; reaching those populations of students out of the educational mainstream still remains a challenge. Economic disparities play a role as well - Solomon suggested that low-income groups more often use computers for lower-order skills, such as drill and practice in mathematics, which can actually have a negative impact on achievement. Meanwhile economically advantaged students are getting more opportunities to use technology for higher-order activities, which are positively related to academic performance. Solomon also highlighted areas of concern to include the quality of hardware and connections, kind of technology use by

students, quality of teachers and leadership. Warschauer (2010) found that a new type of digital divide exists wherein the ability to use new digital media for communication, analysis of information and working with others is not distributed amongst youth in an equitable manner.

Carvin (2006) utilized data from a major federal study conducted in 2004 on Internet usage to explain that the digital divide also exists along the lines of race and education levels, in addition to income. Carvin's research concluded that Latino households were least likely to have Internet access, African-American households were slightly more likely and Caucasian and Asian-American households were most likely to be online. Carvin highlighted the fact that overall Web use rose for each demographic group (60% overall in 2004 compared to less than 20% in 1997), the hierarchy of access remained essentially the same during that period. On the income divide, the study revealed that more than 80 percent of households earning more than $70,000 per year are online, compared to barely 30 percent of households earning less than $15,000 a year. Nearly nine out of 10 households in which someone has attained graduate-level education were online. In contrast, less than one in five households (about 16 percent) without a high school diploma had Internet access.

Research has clearly shown that additional factors promoting the digital divide between the haves and the have-nots still exist. Judge et al. (2006) examined the progress made in bridging the digital divide from the perspective of children's first four years in school. They devised a sample of 8,283 public school children who attended kindergarten, 1st, 2nd and 3rd grades using data obtained from Early Childhood Longitudinal Study-Kindergarten (ECLS-K) conducted by the U.S. Department of Education to report on data collected over children's first 4 years of school. The primary sampling units were geographic areas consisting of counties or groups of counties from

which 1,280 public and private schools offering kindergarten programs participated. Based on the longitudinal study conducted between 1998 and 2004, the researchers found that access to, and use of, a home computer, the presence of a computer area in classrooms, frequent use of the Internet, proficiency in computer use, and low-poverty school status were factors that need to be considered for promoting digital equity and academic achievement. According to the researchers, children attending low-poverty schools had significantly more access to home computers than those children who attended high-poverty schools. Children attending low-poverty schools used the computer most frequently for Internet purposes while those from high-poverty schools used the computer mostly for reading – these differences could have an impact on academic achievement as well. Additionally, many schools across the poverty spectrum had computers concentrated in computer labs – this can be a concern with regards to how technology is used in the classroom.

Resta and McLaughlin (2003) highlighted the need to delve deeper into the issue of digital equity and identified other factors that play a key role in bridging the digital divide to include: access to technology, meaningful, high-quality and culturally-responsive content, trained educators and leadership. The authors pointed out that while online learning content has grown tremendously, there is a dearth of content designed for and by people of minority, ethnic, and tribal cultures, girls and disabled learners. Additionally, while access to computers and Internet has grown tremendously in schools, ways in which teachers integrate this technology in the classroom varies on the basis of their expertise in the technology. Teachers with a high degree of expertise in computer technology used student-centered pedagogical beliefs to facility technology integration into the curriculum. In contrast, teachers who were more comfortable with traditional modes of instruction found it difficult to integrate technology into their classrooms. The

digital divide thus spans across the economic spectrum, languages, special education needs and pedagogy, to name a few.

The growth of the Internet coupled with the use of diverse digital media including television, computers and cell phones has fostered the participation of computer users in online communities. Jenkins et al. (2006) explained that the Internet fosters a participatory culture that enables youth to form affiliations with others using online communities, to express themselves in the digital world, to work online with others and complete tasks, and to experience informal mentorship whereby more experienced members of online communities pass along what is known to novices. They identified play as one amongst a set of new social skills that they considered necessary for young people's participation in the digital world and described it as the capacity to experiment with one's surroundings as a form of problem-solving.

Researchers have identified key learning outcomes for programs that impart technology skills that are relevant in the context of developing programs for bridging the digital divide. Information Literacy, Technology Literacy, Technology Proficiency, and Technology Fluency are some of those learning outcomes discussed in this section. "Information Literacy" has been defined by Kong (2008) as the process of capacity building whereby a learner develops the capacity to work independently and socially, and participates in, benefits from and contributes to the information society and the wider global community. It empowers people with the capabilities to gather, synthesize, analyze, interpret and evaluate the information around them and enables people to understand the rationale behind using information, and to know the reasons for the behavior of information processing. Kong further identified four dimensions of information literacy: cognitive, meta-cognitive, affective and socio-cultural dimensions. While the first two dimensions related to the learners' knowledge about information

processing, the latter two dimensions related to their attitudes towards information processing. The cognitive and meta-cognitive dimensions affect the learners' ability to process digital information while the affective and socio-cultural dimensions affect the learners' inclinations to use that information for the well-being of society.

Crawford and Toyama (2002) defined "Technology Literacy" as the product of a process in which proficiency development is considered a checklist of discrete skills separate from a larger activity. They also considered "Technology Proficiency" as the outcome of a learning process in which students acquire the technology-related skills and knowledge they need in order to participate successfully in the 21st century workforce and become autonomous, life-long learners. In this context, they highlighted the need for technology proficiency assessments in school accountability systems to determine whether all students were being adequately prepared by schools to participate effectively in the workforce. Resnick and Rusk (1996) defined "Technology Fluency" as the end result of a process that encouraged participants to discover their interests, apply their own ideas and gain knowledge of technology while learning with and through computers in a community. They felt that given the support and freedom to pursue their own ideas, young people could get beyond their disinterest and apathy about learning, and develop the internal motivation to learn and grow.

Resta and McLaughlin (2003) discussed ways in which literacy is socially constructed wherein experts decide and document what literacy means for each grade level in school. In the context of computer literacy, the authors suggest that literacies tend to carry a connotation of being fundamentals and building blocks that ultimately form the basis for determining competence. They point out that students of technology should learn where technologies arise from, serve and transform social purpose in situated contexts in ways that transform an inequitable status quo.

Jenkins et al. (2006) suggested that challenges for bridging the digital divide include a "participation gap", and a "transparency problem". "Participation Gap" refers to the unequal access to full participation in the digital world while "Transparency Problem" refers to the challenges faced by young learners to clearly see the ways that media shape their world perceptions. To bridge the digital divide, Jenkins et al. (2006) advocated the development of participatory skills that includes cultural competencies and social skills necessary for full involvement in the digital media world. The Kaiser Foundation published a report that includes television, computers, Internet, music and video as key components of digital media and found that young people significantly increase their use of digital media when they hit the 11- to 14-year old age group (Rideout et al., 2010). The same report also found that Hispanic and Black youth are exposed to digital media for about 13 hours daily compared to just over 8½ hours among Whites.

In summary, the advent of computers, Internet and related technologies opened new doors for learning but inequities in terms of access, learning content and opportunities to effectively use technology for learning has led to a digital divide in learning environments based on socio-economic and gender issues. Access to a computer at home, learning content that is sensitive to the needs of diverse communities and gender, trained educators are some of the means identified by researchers to bridge the digital divide. We will now a take a look at some of the outreach programs that have come into existence with the goal of bridging the digital divide.

OUTREACH PROGRAMS FOR BRIDGING THE DIGITAL DIVIDE

Progress towards equitable technology access and use has been a goal or policy makers and researchers. The U.S. Department of Commerce found in the year 2000 that

household income and minority status significantly affected Internet access (Crawford and Toyama, 2002). During the 1990s, more than 2,000 community technology centers (CTCs) have opened in the United States to provide better access to technology in economically disadvantaged communities and bridge this divide. Consequently, low-income Americans and ethnic minorities with the lowest access to technology are among those most widely served at CTCs (Chow et al., 2000). CTCs are computer labs that are open to the public, driven by and focused on local community needs (Teens and Technology Roundtable, 2002), and predominantly serving low-income and minority populations (Chow et al., 2000). Chow et al. (2000) also found that CTCs are often embedded in existing organizations, such as an After-school (AS) program, church, library, or a community-based organization (i.e., Boys and Girls Clubs, YMCA) and mostly support only basic computer activities (such as word processing, email, and Internet browsing). Other researchers (Vasquez & Duran, 2000; Zhao, Mishra, & Girod, 2000) have found that many after-school centers focus exclusively on youth (unlike CTCs) and have begun to introduce computers, but they too tend to offer only introductory computer activities, along with educational games. Consequently, participants at most of these centers do not become fluent in technology.

Resta and McLaughlin (2003) discussed several programs that have been developed in the US to address the challenge of enabling an equitable distribution of technology between the various groups in society at a time when the use of technology is increasingly widespread. The authors have described instances of K-12 students using digital technologies to shape equitable literacies and learning. Project Fresa was developed to enable third- and fifth-grade Spanish/English bilingual students of strawberry farm workers in Oxnard, California to use technology and find out information relating to how long their family members have worked in the fields, their

health problems, income, etc. The students use this data to develop literacy by making journal entries and creating poetry, thereby developing an increased understanding of their lives. In another instance, K-12 participants in an online community called Kansas Collaborative Research Network (KANCRN) followed guided processes of scientific inquiry using Geographic Information Systems (GIS) visualizations, data collection, and online interaction with peers and experts to generate research questions and engage in research activities.

Salpeter (2006) described several programs that aim to bridge the digital divide by placing laptops or other technology in the hands of all students in a school (or across an entire state) for 24/7 access. One of the programs mentioned by Salpeter is Maine's "Learning Technology" program (www.state.me.us/ mlte) that involves every 7th and 8th grade student and teacher in the state. According to Manchester (2008), 39 percent of Maine eighth graders performed at or above proficiency in 2007, compared with 36 percent in 2002 and 32 percent in 1998. Additionally, the percentage of students in Maine performing below the basic level dropped from 13 percent in 1998 to 10 percent in 2007. Another program mentioned by Salpeter (2006) is Michigan's "Freedom to Learn" (FTL) program (wireless.mivu.org), which establishes 1:1 laptop initiatives in selected low-income communities. FTL provided a complete school improvement program using an education technology package acquired by the state of Michigan that included a totally integrated solution from Hewlett Packard (HP) containing wireless laptop computers, software and learning content. The program also provided a 24/7 help desk, professional development for participating teachers and online assessment tools, in addition to providing the flexibility for each school district to choose between laptops, personal digital assistants (PDAs) or a combination of both. However, this program is currently in doubt because of the downturn in the state's economy (Gunner, 2007). Salpeter (2006)

has also identified a number of district-level initiatives in place around the country, ranging from the well-established Digital Learning Environment in Broward County, Florida (www.broward.k12.fl.us/dles) to a laptop program in the Jefferson County Public Schools in Kentucky.

Researchers have highlighted some outreach programs that utilize refurbished computers to enhance equitable access to computer technology. DePillis (2005) described a program wherein high school students in the technology academy at their high-school in Seattle brought refurbished computers to schools and orphanages in developing areas of the world and taught young people in these areas the skills they needed to advance in an increasingly information-based global marketplace. DePillis found that the students in the academy appreciated and used technology on a much deeper level than many of their peers because they became familiar with how the machine actually works, not just what it does. He felt that this detailed understanding lays the groundwork for possible careers in a variety of technological fields, giving academy students technical expertise that even their Internet-addicted friends couldn't claim. Andrews et al. (2005) studied a project called Floaters.org wherein a community group worked with university researchers to recycle older computers into low-income homes and then monitored the impact of the program for seven years. This project was designed to integrate technology with underserved populations such as those living in poverty, the homeless and people with disabilities. The researchers attempted to study what took place in terms of teaching and learning within the program and also tried to understand whether the structure of the program changed when it was scaled up in size. They found that participants themselves took on the role of peer mentors or mentees, shapers of the program and co-researchers. The project participants also developed

weekly program focus groups to help develop communication mechanisms while the program grew in size.

Some outreach programs have attempted to address issues such as technology support, content and training in the homes of underserved communities. The need to include families of children who participate in outreach programs has also been recognized by these programs. Computers for Youth (CFY) is one such program that provides refurbished computers, affordable Internet access, content and technology support to minority children of middle-school age (Hanrahan, 2000). In a summary of several studies conducted on CFY, Kalra (2004) reveals that program participants were using their computers for meaningful activities such as homework, word processing and finding information. Parents also got trained on using the computer and children are able to show off their newly gained skills to other family members. Additionally, teachers of program participants noticed that the students were turning in homework that was more organized and of higher quality. Finn, Kerman and LeCornec (2004) identified similar programs such as Technology Goes Home (TGH) and Computer Buddies (CB). TGH is a program administered through the Boston Public School wherein students and their parents undergo 25 hours of after-school rigorous training in computer software and Internet. Upon completion of the program, participants can buy a refurbished computer and printer for a nominal fee. The students' teachers provide the training and the program provides an opportunity for parents and students to work together on computers. CB is a program of the South Carolina Department of Social Services that places refurbished computers in the homes of families with at-risk children to support their educational needs. The program recruits and pairs technically trained mentors with at-risk children to encourage greater use of computers.

Rosenbaum (1989) found that the establishment of strong and effective relationships between schools and businesses can improve incentives for students who would like to start working after completing school. Organizations that are for-profits, non-profits and academic institutions have undertaken collaborative efforts to bridge the digital divide. Bill and Motz (2004) posited that there is a various institutions are forming unions to accomplish complex societal changes by finding common ground for sharing social responsibility and developing partnerships. Bill and Motz also found that collaborating institutions are creating project-based learning activities that are aligned with their mission and are linked to the school curriculum. Other research projects have found that when key stakeholders are included in the program, they are more likely to be of high quality (as cited in Harvard Family Research Project, n.d.). These stakeholders include family, community organizations and schools who can create, develop and leverage partnerships between each other. The Harvard Family Research Project cited the example of Boys & Girls Club, whose programs obtained increased referrals and access to information such as school records due to their partnerships with schools, probation and police officers, and community-based providers. Additionally, the researchers noted that programs can also obtain additional in-kind resources, information and other sources for support that enhance their ability to meet their goals, as a result of these partnerships.

Computer and Information Technology companies have also made efforts to bridge the digital divide as part of their efforts to demonstrate corporate social responsibility. Waters (2007) has highlighted some of the programs and suggested that these programs were created to expose users to the tools and technologies they produce and also increase the pool of workers who would be familiar with their tools and technologies. The Bill and Melinda Gates Foundation sponsors three programs for K-12

education: ThinkQuest, an annual competition among students to create the world's best learning website; Think.com, an online learning community for primary and secondary school students; and the new 21st Century Learning Institute. The Intel Education Initiative (by Intel Corporation) focuses its efforts on four areas: professional development for teachers and education leaders, with an emphasis on integrating technology into student-centered curriculum; science and math education and professional development; bringing technology expertise to university campuses "providing student opportunities, and encouraging entrepreneurship"; and K-12 education. Sun Microsystems, through its Open Gateways program, Sun Microsystems Foundation has established educational partnerships with K-12 schools "to bring the power of network computing to teachers and students." Additionally, in San Diego County, the Futures Foundation has partnered with local businesses and Northrop Grumman to provide free computers and low-cost Internet connection to more than 100 families with a foster child (Finn and Kerman (2004). These programs have focused primarily on resource distribution and limited training of youth.

Municipal governments have attempted to bridge the digital divide by providing high-speed Internet access within their cities and counties. The Pew Internet Research (Horrigan & Rainie, 2007) found that several cities in the US including Chicago, Palo Alto, Seattle and Austin contemplated building city-supported networks but obtained mixed results. Carpenter (2010) found that cities such as Philadelphia and New York are planning to provide high-speed wireless Internet access using Wi-Fi technologies – these technologies use an open wireless standard that allows true broadband speeds of up to ten Megabits per second.

In summary, outreach programs and community technology centers have arisen in various communities as a result of government policies and collaboration between

academia, non-profit organizations and for-profit enterprises. While some programs have focused on providing access and developing basic technology skills to the underserved, many other programs have utilized refurbished computers and increased Internet access to provide new learning opportunities. Researchers have noted that most of these outreach programs have provided learning opportunities in technology to underserved communities but more needs to be done. We will now take a look at research efforts that have examined learning goals, methodologies and the kind of learning that is taking place at various outreach programs.

OUTREACH PROGRAMS AND LEARNING

This section now examines the efforts undertaken by researchers to understand the learning goals, methodologies and outcomes that occur at various K12 outreach programs. Members of the Harvard Family Research Project (2008) conducted a two-year longitudinal study on the effects of participation in AS programs that they considered to be of high quality. After reviewing 35 such programs, the researchers found that the participants demonstrated significant gains in standardized math test scores when compared to their peers who were regularly unsupervised after-school. They also found that these programs had a positive impact on the participants' school grades, attendance and their aspirations in general. They however did not review programs that taught technology skills in particular. This subsequent section looks at K12 outreach programs that focused on developing technological skills in particular.

Andrews et al. (2005) indicated that much of the early digital divide research was based on solutions developed in conjunction with community technology centers. As discussed earlier, Andrews concluded that most participants at CTCs do not acquire technological fluency as they focus on basic computer activities. Other researchers found

that introductory computer activities and games have been introduced in after-school (AS) programs that aimed to enhance student achievement for school-age children (Vasquez & Duran, 2000; Zhao, Mishra, & Girod, 2000). Some researchers such as Warschauer (2004) found that many outreach programs enable the access of new technologies to members of low-income and minority communities without taking the local context into consideration often reinforce rote learning activities rather than cognitively demanding activities. Other researchers however, have identified a small subset of after-school centers and CTCs, such as those in the Computer Clubhouse network, which have moved beyond imparting basic computer skills and explicitly focus on the development of technological fluency by helping youth learn to design, create, and invent with new technologies (Resnick et al., 1998). Kafai, Peppler and Chin (2007) studied a Computer Clubhouse in Los Angeles to understand the impact of introducing a new programming environment. They noted that while participants in this program were involved in creating and manipulating multimedia tools, programming skills that denote a higher level of technological fluency was typically absent in these programs due to the absence of support of computer programming within the program. To create a sustainable inclusion of computer programming activities, they suggested that efforts in this direction needed to include the technological dimension (curricular and pedagogical aspects), normative dimension (longstanding norms and conceptions) and political dimension (institutional support within larger community).

Schools are beginning to realize the added value of K12 outreach programs and the programs themselves are getting more focused on providing students with skills that will enable them to be successful (Noam, 2001). Hands-on, project-based learning in a situated context has been the focus of many of these programs. Efforts have been made to develop curriculum that promotes and enables the learners to learn from experts by

interacting with them, modeling experts' behavior and obtaining feedback through a process of legitimate participation in authentic tasks. Solomon (2002) posited that students become empowered as learners and thinkers when they create and share reports, Web pages, or digital presentations that require higher-order skills. Solomon cited an example of a program called ThinkQuest wherein, fifth-grade students developed web pages that demonstrated educational materials for peers to learn from and found that students learn best when they're actively engaged, and technology can motivate and help them use information and resources meaningfully. The researcher also found that the program afforded exposure and recognition for the kids that engendered self-confidence in them.

Wenglinsky (2005) studied the link between computer usage and student test results by analyzing results from the National Assessment of Educational Progress (NAEP) database which contains the results of NAEPs administered every year or two to nationally representative samples of 4th, 8th, and 12th graders. In addition the results data, the database also contains responses from surveys administered to the tested students and their students. After looking at the relationships between the scores and the survey results, he found that the quality of computer work was more important than the quantity and that students could receive a substantial benefit, no benefit, or even negative consequences from working with computers in the classroom, depending on how their teachers chose to use technology. He also suggested that teachers should create assignments that implicitly assume the use of computers by students rather than trying to come up with unique ways for incorporating computers into their students' learning tasks.

Researchers have examined the subject of gender differences relating to the development of technology skills. Dobosenki (2001) advocated the creation of computer clubs for girls and suggested that computer time should be made a social time to help

dispel the idea that computers are lonely and antisocial. After studying ways for increasing technology skills and attitudes towards computers amongst girls, she found that teaching hardware skills helped them learn the language of technology and goal-oriented computer games that involve real-life problem solving and interesting characters promoted computer fluency. Additionally, she felt that computer games for girls should incorporate collaboration, creativity and critical-thinking strategies to solve real-life challenges.

Many programs have attempted to incorporate authentic experiences in learning by drawing upon the cognitive apprenticeship methodology that is based on the socio-constructivist theory of learning. Reigeluth (1999) explained that the socio-constructivist view of education as proposed by Dewey and Vygotsky suggested that students learn by building knowledge through a process of observation, modeling and discourse with experts in a socio-cultural context. Reigeluth also suggested that learners develop their self-esteem and a sense of identity by interacting with the learning community and by viewing other learners as legitimate resources for learning. Piaget (1952) suggested that an authentic activity in a situated learning environment leads to genuine learning. Vygotsky gave primacy to the role of social processes as a learning mechanism and suggested that the specific knowledge structures and learning processes within individuals can be traced to their interactions with others (Palinscar, 1998). Palinscar posited that socio-constructivist theory of learning therefore focuses on the interdependence between social and individual processes for co-construction of knowledge. Lave and Wenger (1991) highlighted the need for helping new learners learn by helping them participate in activities of the community that they are a part of and get engaged in the learning process. Community activities are considered authentic tasks for learning and are therefore framed by the culture of a community of practice (Brown, J et

al., 1989). According to the authors, authentic tasks can enable the learner to progress from being an apprentice to being a collaborator and also fosters reflection during the process. Cognitive apprenticeship (Collins, Brown and Newman, 1991) provides a framework for developing learning strategies that included mechanisms for incorporating communities-of-practice to reinforce cognitive understanding. Learning is promoted through a process of coaching, practice in multiple situations and articulation (discourse). It encourages peers to learn from their interactions, to build stories based on common experiences and to share knowledge building experiences within the group. This environment also provides opportunities to observe and learn from mentors. Cognitive apprenticeship therefore offers a viable model for many outreach programs in the K12 sector.

IMPACT OF OUTREACH PROGRAMS ON LEARNING

Several researchers have focused on evaluating the impact of K12 outreach programs on its participants and answer the question of whether the participants achieved their learning goals for the program. DeAngelis (2001) indicated that "there is no consensus on what makes for a good after-school program" and there is no one-size-fits-all model for designing a successful AS program. Bill and Motz (2004) suggested that community, school and home are the critical components for building an outreach program that fosters effective learning amongst its students. Since successful CTCs and AS programs reflect the unique needs of their community, a holistic view to flesh out the context in which the program functions and affects the child, school and community members is a good way to view and understand a successful AS program. Other researchers have suggested that traditional outcomes-based research and evaluations make it difficult to capture the impact of programs that service teens in a holistic manner

by integrating technology skills development with psychological, emotional, or social development (Teens and Technology Roundtable, 2004). In other words, it has been challenging for researchers to arrive at generalized conclusions and understandings regarding the true impact of outreach programs.

Efforts to assess K12 outreach programs that aim to impart skills in science, engineering and technology have pre-dominantly used survey instruments to obtain feedback from participants. While surveys have remained dominant, some researchers have developed additional assessment tools for enabling more comprehensive evaluation of program impact. Poole, et al. (1999) developed composite assessment tools that included participant feedback from teachers and students, long-term outcomes assessment of teachers and tools for embedding assessment in the classroom. These tools were developed as part of an effort to assess an outreach program that conducted workshops targeted towards late-elementary and middle-school teachers and students. Feedback from participants at the teacher workshops were obtained through a questionnaire on strengths, suggested improvements and learning outcomes. Pre- and post-workshop surveys were also developed to develop baselines, assess level of comfort with subject matter and instructional techniques. An embedded assessment process was also developed by using a matrix that matched state educational content standards with specific performance criteria and correlated it with expected learning outcomes. The researchers concluded that clear goals, realistic appraisal of available resources and a plan for incorporating feedback into the program were critical for the success of a comprehensive assessment of a K12 outreach program.

Denner and Werner (2007) conducted a qualitative study of an AS program called "Girls Creating Games" in central California wherein participants designed and programmed computer games. The study was conducted with 126 middle school girls

(58% White and 31% Hispanic/Latino) from a small urban community in Central California who voluntarily participated in the program. Over 33 meetings, the girls designed and programmed a narrative game using the software Flash MX from Macromedia. A notebook was provided to the girls in pairs using which they answered questions during program meetings. Some of the girls were also audio-taped for 30 minutes while they worked on their computers. This data was then coded in a multi-step process and then analyzed. The researchers showed that girls were able to work in pairs, monitor and assess their problem solving activities and produce software.

Reisner, et al. (2007) explored ways in which AS programs could contribute to certain desired psychological, social and academic outcomes for disadvantaged youth by conducting a longitudinal study of 35 high school AS programs (2,914 participants). Each program selected for the study served at least 30 participants between elementary and middle-school grades and were located in high-poverty communities. These programs were offered at no cost to the parents and positive participant outcomes had been recorded in prior years of operation. The researchers verified the quality of the program each year through annual visits to conduct interviews and observe youth activities. Periodic surveys were conducted with participants, teachers and parents to measure the social, academic and behavioral functioning of study participants. Cluster analysis was used to determine predominant activity patterns and used hierarchical linear modeling to analyze their effect on the participants' developmental and academic outcomes. The researchers concluded that participants were able to improve their work habits and conduct after the program and academically fared significantly better than their peers who were unsupervised after-school hours.

Several 21st Century Learning Centers in Louisiana were evaluated by Jenner and Jenner (2007) using a quasi-experimental design. 1,192 third- and fifth-grade students

who were considered low-income, at-risk had attended the program for at least thirty days and were the subjects for the study. The students were administered a standardized test taken by all same grade students in Louisiana in the Fall semester as a pre-test while the same test in the subsequent Spring semester was used as a post-test for the study. The researchers found that the program was having a positive academic impact on participants who attended the program for more than 30 days. Their attendance record also had a direct impact on their academic achievement.

At an after-school technology education center in Sweden that provided hands-on technology education for students aged 6-16 years, Salminen-Karlsson (2007) examined the effects of the use of single-sex groups in increasing the interest of girls and boys in technical activities by conducting an ethnographic study. After analyzing data collected from observations made on thirty activities in different courses, fifteen interviews with staff, review of several documents and 200 responses to questionnaires sent to program participants, the researcher found that the groupings alone do not break down gender barriers. The researcher also found that the gender of instructors and staff, the content of the activities and the gender composition of the student body were factors that impact the effectiveness of the program as well.

In summary, while many outreach programs have focused on providing computer access and building low-level technical skills amongst participants, some outreach programs have focused on developing technological fluency and literacy by using the theories of constructivism and socio-cultural learning. Cognitive apprenticeship has been suggested in the literature as an instructional mechanism based on socio-cultural theory of learning that would provide opportunities for the learners to bridge the gap between the abstract concepts taught in schools with the real-world tasks that can enable the learner to make their cognitive learning explicit. Researchers have found that many

outreach programs were effectively helping its participants learn the specific activities outlined in those programs. There have only been limited studies however, that focus on middle-school based outreach programs. According to Wheelock and Dorman (1988), assignments and responsibilities that provide tasks and objectives within reach of middle-school students' potential can stimulate commitment and effort. Pittman et al. (2004) explained that the development of 21st century skills includes information and media literacy skills and multimedia communication skills. It would be worthwhile to explore the effectiveness of outreach programs that aim to impart these skills to middle-school students. We will now explore the question of whether participants who learn technology skills in outreach programs develop a greater belief in their ability to use computers.

SELF-EFFICACY IN COMPUTERS

Researchers have considered the role of self-efficacy in enabling learners to be members of the 21st century workforce and have reported self-efficacy beliefs as a major factor in understanding the frequency and success with which individuals use computers. Self-efficacy refers to people's optimistic beliefs about their ability to reach their goals and is derived from his socio-cognitive theory which posits that learning is facilitated by cognitive development in a social context. Bandura (1997) defined self-efficacy as individuals' confidence in their ability to organize and execute a given course of action to solve a problem or a task and explained that efficacy expectations determine the levels of effort and persistence that individuals put into their learning activities. Bandura also suggested that perceived self-efficacy reduces anticipatory fears and inhibitions in addition to determining how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences. He regarded the belief in self-efficacy as the foundation of human motivation, well-being and personal

accomplishments and suggested that learners develop a sense of collective agency (people acting in concert to shape their future) while working together in a social setting. Bandura (1997, 2001) also explained that changes in self-efficacy can be caused through mastery experiences, vicarious experiences modeled by others, verbal persuasion and people's own physiological indicators/states resulting from an attempt to achieve. He also found that in a learning environment, teacher self-efficacy can negatively or positively impact student self-efficacy.

Bandura (2001) indicated that self-efficacy is domain-specific and suggested that domain-specific measures for self-efficacy are more useful than a general measure. In this regard, the term "Occupational Self-efficacy" has been developed by some researchers and was pioneered by Hackett and Betz (1981). This term refers to the belief that one can succeed in a particular job. Since career and work-related goals are an important goal of many outreach programs that attempt to build technology skills amongst its participants, it becomes important to further define self-efficacy in terms of computers and the Internet. Computer self-efficacy represents an individual's perceptions of his or her ability to use computers for accomplishing a task (Compeau and Higgins, 1995). Compeau and Higgins also explain that self-efficacy can be judged on three dimensions: magnitude, strength and generalizability. Individuals with a high magnitude of self-efficacy will see themselves as able to accomplish difficult tasks, while those with low self-efficacy magnitude will only believe that they can execute simple tasks. Individuals with strong sense of self-efficacy will be more persistent in overcoming obstacles while those with weak self-efficacy will be easily frustrated by obstacles. In the generalizability dimension, some individuals can be seen as believing that they can execute a particular behavior under any circumstance and can also perform behaviors that are slightly different while others may believe that they can only perform

under a certain set of circumstances. Eastin and LaRose (2006) defined Internet self-efficacy as a belief in one's capabilities to organize and execute courses of Internet actions required to produce given attainments. They suggested that people with low confidence in their ability to use the Internet, who are dissatisfied with their Internet skills and are uncomfortable using the Internet have low self-efficacy beliefs and are less likely to use the Internet. They considered Internet self-efficacy to be a potentially important factor in efforts to close the digital divide that separates experienced Internet users from novices.

Researchers have attempted to identify some of the factors that affect self-efficacy. Bandura and his fellow researchers (Bandura et al., 1996) found that parents' self-efficacy beliefs and goals for their children significantly affected the offspring's self-efficacy beliefs as well. As mentioned earlier, Bandura (1997) had also found that in a learning environment, teachers' self-efficacy beliefs affect the students' self-efficacy beliefs as well. Miura (1987) found gender to be a factor in developing computer self-efficacy while conducting a study with 368 undergraduate students (104 males, 264 females) who were enrolled in a lower division course to fulfill a general education requirement at a large urban university in California. A two-page questionnaire was used to obtain background information while additional sections attempted to measure self-efficacy with regards to computer programming, computer coursework and personal uses of the computer. He found males to have significantly higher computer self-efficacy than females. They also identified other predictors of computer self-efficacy: completion of a high-school computer programming course, college major and past enrollment in a college computer science class.

Cassidy and Eachus (2002) reported that the quality of computer experiences affects computer self-efficacy (CSE) beliefs in addition to gender. They conducted a

study amongst 212 randomly drawn research subjects drawn from a university and from Internet users worldwide to assess computer self-efficacy and found that computer ownership, computer training and positive computer experiences contributed to higher CSE. The researchers also developed an instrument containing a 30-item scale to assess computer self-efficacy. They found that positive experiences with computers have a greater effect in increasing self-efficacy rather than the quantity of time spent on computers. Durndell and Haag (2002) conducted a study amongst 150 students (74 female, 76 male) at a Romanian university to understand computer anxiety, attitude towards the Internet and CSE. The researchers used a Computer Anxiety Rating Scale to assess anxiety levels and used an Internet Attitude Scale to assess attitudes of the participants towards the Internet. Torkzadeh and Kouftero's (1994) Computer Self Efficacy scale was used with minor modifications to assess computer self-efficacy. They found that lower computer anxiety promoted higher CSE, which in turn promoted positive attitudes towards the Internet. Vekiri and Chronaki (2008) examined relations between outside school computer experiences, perceived social support for using computers, and self-efficacy and value beliefs about computer learning for 340 fifth- and sixth-grade students (174 boys, 166 girls) from seven elementary schools in Greece. Students came from diverse family backgrounds and most of them used computers either during their regular school program or during an optional afternoon program offered for working families. Each student completed a self-report questionnaire that focused on students' experiences and beliefs in computers and math. Vekiri and Chronaki found that parental support and to a lesser extent, peer support, strongly affected boys' and girls' computer self-efficacy and value beliefs and found that computer access was not related to their motivation.

Hsu and Huang (2006) surveyed 235 students from a vocational college and technology university to study computer self-efficacy determinants from the perspective of participant internal learning motivations (interest, trend and employment) and external learning environments (home and school). The researchers felt that students learn new technologies due to interest or perceived enjoyment. Their expectations with regards to a good job or personal growth due to new computer skills can be additional motivators as well. The researchers included home and school as the external learning environments because they felt that learning mostly takes place in those environments. The researchers found that computer use and interest had a direct and positive impact on their computer self-efficacy while the home environment and employment factors had an indirect, but positive, impact on computer self-efficacy. While the study participants indicated that they were not satisfied with their school learning environment, it did not affect their sense of computer self-efficacy.

Liu et al. (2006) examined the effect of computer-enhanced problem-based learning environment on middle school students and focused on the subject of science. 549 sixth-graders (271 female, 278 male) from a middle school participated in the study and used a CD-based hypermedia PBL (problem-based learning) environment called "Alien Rescue" for three weeks to use problem-solving skills for acquiring knowledge about our solar system. A 25-item test was devised and used for pre- and post-test purposes. Students' self-efficacy beliefs in science were measured using eight items from the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1993) that dealt specifically with students' self-efficacy for learning and performance. The students' attitude towards science was measured in this study as well. They found that the computer-based PBL environment increased the students' science achievements and their

self-efficacy for learning science and also suggested that self-efficacy could predict their academic achievement as well.

Bandura (1986) advocated that training to increase students' self-efficacy might focus on improving students' actual computer skills through modeling, successful hands-on experiences, and positive verbal feedback. Some researchers have investigated whether K12 outreach programs that impart technology skills can promote self-efficacy amongst its participants and have attempted to develop research instruments for the purpose. One such study conducted by Andrews et al. (2005) was described earlier. After conducting a project to understand the impact of integrating computer technology on sections of the society that did not have sufficient skills and access to technology, they could not definitively conclude whether occupational self-efficacy (the belief that one can succeed in a particular job) was promoted amongst participants. They felt that the events of September 11, 2001 might have had some effect on the study.

Turner and Lapan (2005) evaluated an intervention program to increase career-related self-efficacy amongst middle-school students. Using a quasi-experimental, non-equivalent groups design, 160 middle school students (85 boys, 75 girls) from two ethnically diverse middle schools in a lower-middle to middle-class neighborhood were assigned randomly to treatment and control groups. A computer-assisted intervention activity containing modules for career exploration, career mapping and interpretation was administered to the treatment group. The researchers found that young adolescents' career-related self-efficacy and interests in non-traditional careers can be increased through their participation in computer assisted career intervention and group exploration activities.

Enoch and Riggs (1993) developed a tool, known as Microcomputer Beliefs Inventory (MBI) to measure the self-efficacy and outcome expectancy beliefs of middle

school students toward computers using a 5-point Likert scale (strongly agree, agree, uncertain, disagree, strongly disagree). They conducted a study with the instrument on a sample of 269 suburban middle-school students (144 males, 125 females) and concluded that that the MBI was a valid and reliable instrument for investigating middle school students' beliefs about computers. They also found that prior experience with a computer at home positively affected their computer self-efficacy beliefs. However, they found a very weak correlation between high science self-efficacy beliefs and high computer self-efficacy beliefs. Torkzadeh et al. (2006) developed a contingency model of computer and Internet self-efficacy that was based on an assumption that user attitude and computer anxiety influence the development of computer and Internet self-efficacy. Responses to a survey instrument containing measures of computer self-efficacy, Internet self-efficacy, user attitude and computer anxiety was collected from 347 business undergraduates (201 male, 146 female) at a large state university. They found that training significantly improved computer and Internet self-efficacy. They also found that participants with favorable attitudes towards computers and low computer anxiety improved their computer and Internet self-efficacy through training than individuals with unfavorable attitudes and high computer anxiety. In other words, the interaction between attitude and anxiety towards computers significantly affected computer self-efficacy.

In summary, computer self-efficacy beliefs can be enhanced by exposing participants to computers and providing opportunities for learning computer skills. An enhanced belief in one's computer self-efficacy can help him/her develop and enhance his/her technology skills in the future. Several researchers have developed instruments for assessing computer self-efficacy and they can be useful in understanding the impact of outreach programs that impart technology skills to its participants. This researcher is greatly interested in exploring whether K12 outreach programs include the attributes

suggested by Bandura in their program and whether they promote self-efficacy amongst its participants.

SUMMARY OF LITERATURE REVIEW

In conclusion, this researcher's review of the academic literature has found that bridging the digital divide has come to mean not just equitable access to computer technology but includes equitable distribution of technology, diverse learning content, and equitable opportunities to learn how to effectively use technology in their daily lives. Researchers have found that providing new or refurbished computers to students needs to be blended with authentic tasks geared towards technology skills development. While many outreach programs have focused on providing access to computers for underserved communities, other programs have established the development of technological skills as a goal for its participants. Researchers have also established that computer self-efficacy and Internet self-efficacy can be promoted through training and many more research efforts are needed to understand how outreach programs can foster computer self-efficacy amongst its participants. While a number of programs exist for K12 students and technology education, very few efforts have been undertaken to assess the impact of AS programs that teach technology skills, on the learners and their families.

Additionally, middle school represents a particularly critical time for children. According to Wheelock and Dorman (1988), academic frustrations and alienation in the middle grades are key reasons why older adolescents drop out of school. Assignments and responsibilities that provide tasks and objectives within reach of their potential can stimulate commitment and effort. According to George (1992), instructional strategies that are directed towards helping middle school students become competent doers and establish their individual worth and respectability amongst their peers and parents go a

long way towards enriching the school experience for adolescents. The development of 21st century skills includes information and media literacy skills and multimedia communication skills (Pittman et al., 2004) and there have been limited studies on the impact of middle school-based outreach programs on participants and their families.

Due to the diverse nature of the programs and differences in the situated context of these programs, qualitative and ethnographic methods can be effective research methods for increasing our understanding of the impact of these programs. Additionally, these research efforts can help in the design and development of enhanced outreach programs that bridge the digital divide and also enhance the ability of learners from underserved communities to improve their computer self-efficacy beliefs.

SUMMARY OF THE PROBLEM STATEMENT AND BENEFITS

This study will add to existing research on understanding the impact of K12 after-school programs and aim to understand the impact of a middle-school after-school program that imparts technology skills to participants and their families who are from underserved communities and are considered at-risk at school. The study will focus on understanding how the introduction of a computer into participants' and their families into their home impacts them and will assess the impact of the program on the participants' self-efficacy beliefs about their computer skills.

Additionally, the researcher will develop a detailed account of the program's impact on program participants and their families in addition that includes description of ways in which increased access and skills with computers had an impact on the learners' behavior and their relationship with their families.

Chapter 3: Methods

This chapter explains the methodology and methods used in understanding the impact of a middle-school after-school program that imparts technology skills on its participants and their families. The outreach program that provided the context for the study is described in this chapter and is followed by the research questions for which the researcher attempted to find answers during the study. The participants in the study, the approval process, the data collection process and the process used for analysis form the remaining sections of this chapter.

RESEARCH QUESTIONS

The following questions were addressed during this study:

1. How did participation in the program affect students' self-efficacy beliefs in their computer skills?
2. How has the introduction of a computer and Internet connectivity into the learners' homes impacted the learners and their families?
3. How did the change in computer self-efficacy beliefs in participants impact their usage of computer and Internet connectivity at their homes?

RESEARCH SETTING

Hi-Tec, Inc. launched a nationwide program called Hi-Tec CompNow in 2002 that focused on developing local partnerships to provide low-income or underserved middle school students the opportunity to earn a refurbished home computer and learn technology skills to better prepare them for opportunities in today's technology driven world. The main aims of this program were to help middle school-age children, especially girls, to develop 21st century technology skills, expand their intellectual

curiosity, increase their self-esteem, and become coaches and mentors to other family members who may lack technology skills.

This program was conducted as an after-school, 40-hour, self-paced, hands-on course where participants learned computer basics and earned a refurbished desktop computer after completing of the course. Hi-Tec partnered with local non-profits to manage these programs for school districts that were interested in addressing digital equity issues at their middle schools. The middle schools provided a classroom, computer lab, participants and instructor for the program. Hi-Tec provided refurbished computers and training curriculum to the program from 2002 to 2008. During spring 2008, they decided to solely focus on providing the curriculum for computer training and stopped providing refurbished computers to the program. Since then, the local non-profits have provided refurbished computers to the program.

This study was conducted at Central Texas Middle School (CTMS) located inside the Central Texas Independent School District (CTISD). CTMS had an accountability rating of "Academically Acceptable" and had 72% Hispanic, 17% white and 10% African-American students. Desktop computers were provided by Central Texas Partners in Education (CTPIE), a TexTown-based non-profit organization that managed the CompNow program for CTISD. These computers were donated by the local community to CTPIE who refurbished them at a CTISD high school and delivered them to CTMS at the beginning of the program. The computers varied in age (five to seven years old), quality and configuration. Therefore, the program instructor reviewed the computers during the weekend prior to the first week of the program to ensure that each computer was clean, functional and included a desktop computer, keyboard, mouse and monitor. The instructor cleaned those computers that were dirty and worked with CTPIE to obtain any components that were missing from the computers. Since the computers varied in

quality, the instructor introduced a lottery system to ensure fairness while assigning computers to program participants. He assigned a number to each computer system, wrote each number on separate pieces of paper, folded them and put them in a basket. Students were requested in alphabetical order to pick a number from the basket and receive the computer system which was assigned the corresponding number.

To enlist participants for the program, CTMS teachers distributed flyers about CompNow to its students and encouraged them to apply for admission into the program. Interested students filled out entry forms requesting information which enabled the selection of program participants based on the following criteria suggested by Hi-Tec:

a. Economic criterion – was the student's family economically disadvantaged?

b. Technology awareness criterion – did the student already have a computer at home? If not, did the student or the student's family have access to a computer at work? Did the student have an interest in learning computer skills?

c. Performance at school – Does the student need help in improving their grades?

d. Current grade the student was in – students in 8th grade got the higher priority than students in 7th grade and 6th grade.

Program participants were selected by Mr. Richardson, CTMS CompNow program instructor in consultation with Ms. Ann Stanley, CTMS Principal. The suggested selection criteria were not fully followed for participant selection; some students who did not meet the selection criteria were allowed to participate in the program. Fourteen students chose to attend the program although more students were selected for participation. Based on the researcher's review of the data provided by participants on the information forms, only eight out of the fourteen students seemed to have met either the "economic criterion" or the "technology awareness criterion".

An introductory CompNow session was conducted by the program instructor that was attended by thirteen program participants and their parents. This session enabled the instructor, participants and parents to discuss the logistics, duration and learning content of the CompNow program. During the 10-week long program, thirteen out of fourteen students completed the program and received a certification of completion, a desktop computer and dial-up Internet account at a special graduation ceremony held on the last day of the program at the CTMS library. Parents attended this graduation ceremony and helped their children take the computer to their homes. One student missed a number of program sessions and was not allowed to 'graduate' from the computer. He made a commitment to the instructor to participate in the next edition of the program and earn his own computer. At the end of the program, CTPIE conducted a program survey on behalf of Hi-Tec with school and school district personnel to obtain feedback about the program. Although the researcher did not obtain the results of the survey, a review of past results indicated that school district personnel generally provided favorable ratings to the CompNow program. Details about the researcher's analysis on previous surveys are provided in Appendix H.

PARTICIPANTS

The subjects for this study (called as 'Participants' henceforth) were students at Central Texas Middle School (CTMS) who completed the spring 2009 edition of the Hi-Tec CompNow program (called as 'Program' henceforth). Additional subjects in this study included the parent(s) or guardian(s) of participants (called as 'Parents' henceforth). Henceforth, participants and parents who met the "Technology awareness criterion" and/or "Economic criterion" outlined in the previous section are referred to as "Target Population" and the remaining participants are called as "Non-Target

Population". The Target Population therefore represented those who were economically disadvantaged and did not have a working computer with high-speed Internet in their homes at the beginning of the program.

DATA COLLECTION

The following procedure was followed to enable data collection for the study:

1. Obtained permission from Ms. Beth Hernandez, Manager, Hi-Tec CompNow program to conduct this ethnographic study
2. Worked with CTPIE to identify a school for the study
3. Met with the Coordinator of External Research, CTISD to discuss process for obtaining approval from CTISD for the qualitative study
4. Met with the Ms. Stanly, CTMS Principal to discuss the project methodology
5. Met with the Mr. Richardson to identify past Hi-Tec CompNow participants for the study
6. Developed a set of questions to be used as a guide for interviewing the students and their families
7. Obtained approval from CTISD for the study
8. Prepared the IRB application for review by UT Institutional Review Board (IRB) and obtained approval for the study
9. Attended and observed a complete instance of the Hi-Tec CompNow program at the school during spring 2009
10. Administered a questionnaire to measure computer self-efficacy of participants at the beginning of the program
11. Developed brief field notes by observing the program and participants during the course of the program

12. Administered a questionnaire to measure computer self-efficacy of participants at the end of the program
13. Obtained consent from parents of participants to contact them later for conducting interviews
14. About six months later, researcher contacted the students and their families and scheduled interviews at either their homes or at a public library near the school
15. Conducted interviews using the set of guided questions and digitally recorded the interviews
16. Transcribed the recorded interviews
17. Organized the data in Nvivo (a qualitative analysis software).

DATA SOURCES

Data for analysis was gathered from the following sources:

1. *Participant Work Book:* The program curriculum made provisions for the program participants to undertake exercises relating to computer hardware, software and the Internet. Additionally, participants reflected on their in-class experiences and made notes at periodic intervals in the program.
2. *Computer Self-efficacy Questionnaire Responses:* To assess the changes in computer self-efficacy, the researcher administered a questionnaire at the beginning and end of the program to help understand the impact of the program on participants' self-efficacy beliefs about their computer skills. This questionnaire was developed by Cassidy and Eachus (2002) to measure general computer self-efficacy. The researchers tested the instrument for internal consistency (Cronbach's Alpha =0.97, N=184) and reliability (r=0.86, N=74, $p<0.0005$) and obtained high scores. Additionally, the instrument was favorably

tested for validity by correlating the self-efficacy scores with a self-reported measure of computer experience ($r=0.79$, $N=212$, $p<0.0005$) and with number of computer packages used ($r=0.75$, $N=210$, $p<0.0005$). The instrument was also tested for criterion validity by computer total computer self-efficacy scores across five groups (formed by profession). Analysis showed that software engineers scored significantly higher than all other groups followed by Internet users and radiographers. Nurses and physiotherapists scored equally. The instrument was therefore considered appropriate for use. Although the researchers developed the instrument to assess computer self-efficacy of adult learners, the researcher felt that this was an appropriate instrument to use for middle-school students as well because the language used in the instrument was simple enough for middle-students to understand and the instrument measured general computer self-efficacy rather than measuring additional attributes such as programming, multimedia, etc. The questionnaire along with the scoring method is shown in Appendix B. This enabled the researcher to perform a comparative analysis of the computer self-efficacy beliefs of the program participants before and after the program.

3. *Field Notes:* The researcher attended and observed the program during Spring 2009 at CTMS and made brief field notes about the program. These field notes as a volunteer-observer helped the researcher analyze the impact of the program on their computer self-efficacy perceptions.

4. *Recorded Interviews:* During the last day of the program, parents and participants met with the Mr. Hal to attend a 'Graduation Ceremony" where the participants formally received the program computer and took it home. The researcher utilized this event to inform parents and participants of the study and obtained

their written approval for their participation in an interview that would be conducted at a location of their choosing (preferably their home) about six months later. The researcher felt that six months represented a sufficient timeframe for understanding the impact of the program on participants and their families. The researcher attempted to contact all participants after at least six months had elapsed since the program ended. Interviews were scheduled with parents on a "First Come First Serve" basis. The researcher was able to meet and interview seven families for this study – the researcher was not able to meet with the remaining families despite his best efforts because either their phone numbers were no longer working or they were non-responsive. The interviews were held either at the participants' homes or at a public library located very close to the school. The focus of this effort was on understanding how the program and the entry of a computer into their home had impacted their lives. A set of guiding questions were prepared by the researcher and are included in Appendix C. Interviews were audio recorded, transcribed and then coded by the researcher for analysis.

DATA ANALYSIS

The researcher used statistical methods to analyze the Computer Self-Efficacy Questionnaire responses (Results are documented in Chapter 4). The Mean, Median, Mode and Standard Deviation for both pre-program and post-program scores were calculated. A Paired T-Test and Wilcoxon Signed-Rank Test were conducted to determine whether changes in participants' CSE scores were statistically significant. The researcher reviewed the remainder of the data extensively and coded it for qualitative analysis. A 'code book' was developed and is included in Appendix E.

The researcher felt that participants in the program developed a sense of what it means to know about computers by first developing their computer skills with the help of a mentor and then by interacting with their peers. They thus developed a sense of 'meaning' to their learning process that was social – this meaning was derived from the objects themselves (computers) in a social context (situated learning). This learning was both constructionist and constructivist because the learner not only learned from the computers and the situated learning environment but also constructed his/her sense of meaning based on his/her individual context. Therefore, the constructionist paradigm informed this study from an epistemology perspective.

To answer the research questions identified for the study, the researcher analyzed the data gathered from participants' computer self-efficacy (CSE) scores, participants' program workbooks and the researcher's interviews with parents and participants to provide an interpretative account of the impact. The researcher developed codes to conduct the qualitative analysis of the data using Nvivo (Version 9) and relied upon key findings gleaned from his earlier review of published literature to help refine the codes and develop the code book (included in Appendix E).

To answer the question about how the participants' self-efficacy beliefs in their computer skills were impacted by their participation in the program, a comparative analysis of the participants' scores for the self-efficacy assessment questionnaire administered before (pre-test) and after (post-test) the program was conducted using statistical methods. The researcher conducted a paired t-test to determine whether differences between pre-test and post-test scores were statistically significant. The researcher could then also conclude that the program positively impacted participants' self-efficacy beliefs about their computer skills if the scores significantly went up during the post-test phase. Since the sample size was small, the researcher also conducted the

Wilcox Signed-Ranks Test, a non-parametric test, to determine whether differences between pre-test and post-test scores were statistically significant under an assumption that the sample population was not normally distributed.

The researcher then attempted to understand the initial circumstances under which participants entered the program as this has an impact on their pre-program CSE scores. After reviewing the pre-program CSE scores of participants, the researcher analyzed the program activities undertaken by Participants during the program to identify factors that might have affected their post-program CSE scores. Post-program CSE scores were then reviewed by the researcher. Some of the key factors identified in the literature published on computer self-efficacy helped prepare the codes used for the qualitative analysis and are mentioned below.

Hsu and Huang (2006) found that computer use and interest had a direct and positive impact on their computer self-efficacy while the home environment and employment factors had an indirect, but positive, impact on computer self-efficacy. They also felt that students learn new technologies due to interest or perceived enjoyment. Vekiri and Chronaki (2008) found that parental support and to a lesser extent, peer support, strongly affected boys' and girls' computer self-efficacy and value beliefs. Bandura and his fellow researchers (Bandura et al., 1996) found that parents' self-efficacy beliefs and goals for their children significantly affected the offspring's self-efficacy beliefs as well. Bandura (1997, 2001) also explained that changes in self-efficacy can be caused through mastery experiences, vicarious experiences modeled by others, verbal persuasion and people's own physiological indicators/states resulting from an attempt to achieve. Bandura (1986) also advocated that training to increase students' self-efficacy might focus on improving students' actual computer skills through modeling, successful hands-on experiences, and positive verbal feedback. Torkzadeh et

al. (2006) found that participants with favorable attitudes towards computers and low computer anxiety improved their computer and Internet self-efficacy through training.

To answer the question about how the CSE beliefs in participants impacted their usage of computer and Internet connectivity at their homes, the researcher analyzed the interview data to further understand perceptions of parents and participants with respect to CSE. Key conclusions drawn by the researcher from his literature review aided the identification of codes for qualitative analysis. The literature review indicated that self-efficacy beliefs impacted the frequency and success with which individuals used computers. The review also suggested that enhanced computer self-efficacy beliefs could help them develop and enhance their technology skills in the future in addition to promoting positive attitudes towards the Internet.

Furthermore, the researcher also developed codes to capture the general feelings of parents and participants towards computers and computer activities and to identify changes in participants' interactions with their family, teachers and friends. Ways in which participants took on the role of mentor or working with people in positions of authority (teachers, parents, older siblings) were coded and analyzed as well.

To answer the question about how the introduction of a computer and Internet connectivity into the learners' homes impacted the learners and their families, the researcher analyzed the interview data to develop a subjective account. As a first step, the researcher explored the parents' and participants' background to understand the extent to which they were using computers prior to the program. Perceptions about the program, the computer and Internet connectivity that were shared by parents and participants during the interview were then coded and analyzed to understand their impact on parents and participants. Some of the key factors identified in the literature published on digital equity informed the coding process and are mentioned here. From a

digital equity perspective, Solomon (2002) highlighted areas of concern to include the quality of hardware and connections, kind of technology use by students, quality of teachers and leadership. Access to technology and meaningful, high-quality content that was culturally responsive – these were identified as two critical factors that play a key role in bridging the digital divide by Resta and McLaughlin (2003). Crawford and Toyama (2002) considered "Technology Proficiency" as the outcome of a learning process in which students acquire the technology-related skills and knowledge they need in order to participate successfully in the 21st century workforce and become autonomous, life-long learners.

The researcher also developed codes to understand whether participants increased their computer and Internet usage after the program. Perceptions about the computer's quality, Internet service provided by the program and software provided by the program were also coded to understand their impact on parents and participants.

Upon completion of the analysis, the researcher developed a case description for each participant who participated in an interview (along with his/her parent(s)) with the researcher. These cases along with a description of the results of the statistical analysis of the CSE scores are presented in the next chapter.

Chapter 4: Results

This chapter begins with the results of the statistical analysis conducted on the pre-program and post-program CSE scores. Detailed case descriptions of participants who were interviewed by the researcher after at least six months had elapsed since program completion are then presented. Each case description also provides answers to the research questions for this study. Finally, the chapter concludes with a summary of the results.

PROGRAM IMPACT ON PARTICIPANT COMPUTER SELF-EFFICACY SCORES – A STATISTICAL ANALYSIS

A CSE Questionnaire (shown in Appendix B) was administered to participants on the first and last days of the CompNow program to obtain a score of participants' computer self-efficacy beliefs. Twelve students completed the program and also completed CSE questionnaires on the first and last days of the program. One student came late to the session on the first day and did not complete the CSE questionnaire. Another student was not allowed to graduate from the program due to frequent absences from program sessions; he did not complete the post-program CSE questionnaire. The figure below illustrates the scores obtained by twelve participants who graduated from the program and completed the CSE questionnaire.

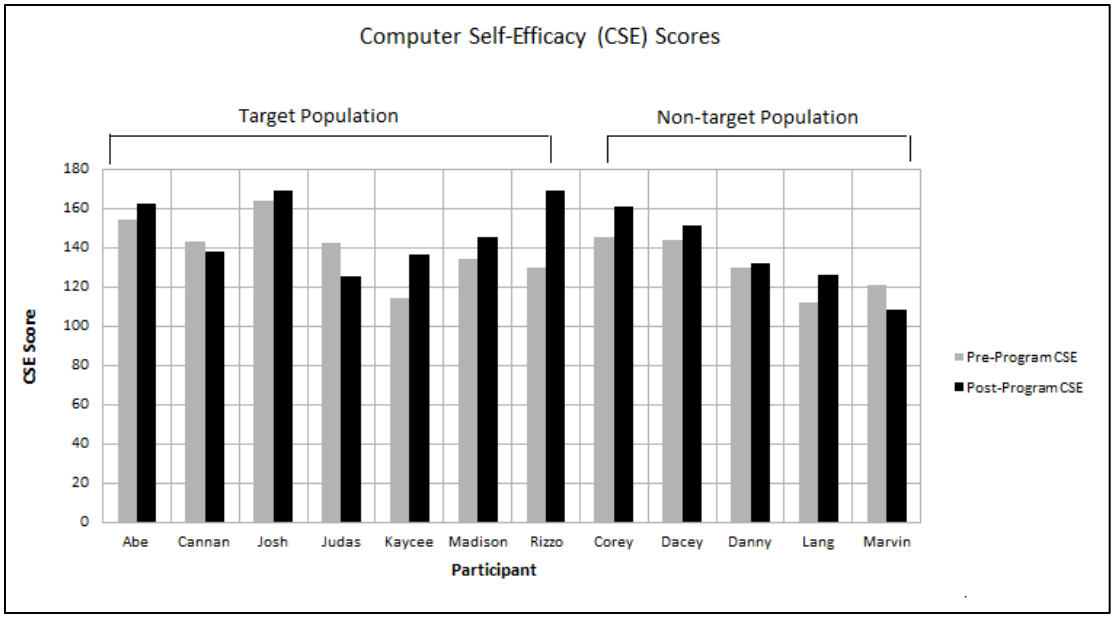

Figure 1: CSE Scores Before and After the Program

The table below provides a comparison of CSE scores before and after the program.

Table 1: Pre- and Post-Program CSE Comparison

	Overall		Target Population		Non-Target Population	
CSE Score	**Pre-Program**	**Post-Program**	**Pre-Program**	**Post-Program**	**Pre-Program**	**Post-Program**
Mean	136.08	143.50	140.14	149.14	130.40	135.60
Median	138.00	141.50	142.00	145.00	130.00	132.00
Mode	130.00	169.00	#N/A	169.00	#N/A	#N/A
Highest	164.00	169.00	164.00	169.00	145.00	161.00
Lowest	112.00	108.00	114.00	125.00	112.00	108.00
Maximum Possible	180.00	180.00	180.00	180.00	180.00	180.00

The data indicated that the Target Population had higher pre- and post-program CSE scores than the Non-target Population. Josh, a member of the Target Population, had the highest pre-program CSE score and shared the highest post-program CSE score with Dacey from the Non-Target Population.

A paired t-test was performed on the scores of all participants, with both Target and Non-target populations considered as one group, to determine if CSE scores at the end of the program changed significantly from the CSE scores at the beginning of the program at a risk (α) level of 0.05. The data analysis is illustrated in Appendix F. The null hypothesis stated that there was no change in CSE scores before and after the program. The alternate hypothesis stated that there was a change in CSE scores before and after the program. The degree of freedom was 22, and no assumption was made about the direction of any change in scores. The researcher failed to reject the null hypothesis after the test yielded a p-value of 0.12. This implied that the change in CSE scores was not statistically significant at α level of 0.05.

The researcher then conducted a Wilcoxon Signed-Rank Test on the same group's CSE scores to determine whether the differences in pre-program CSE scores and post-program CSE scores were statistically significant under the consideration that the sample population cannot be assumed to be normally distributed. This non-parametric statistical hypothesis test considered a null hypothesis stating that pre-program and post-program CSE scores for the sample are unchanged, while the alternate hypothesis states that there is a change in the scores. The data analysis is illustrated in Appendix G. This test resulted in a p-value of 0.07, indicating the null hypothesis could not be rejected for the sample. This result implied that the changes in CSE scores due to the program were not statistically significant. A review of the signs associated with the differences, however, showed that CSE scores were positively impacted by the program for 9 out of 12 participants as illustrated by the figure below.

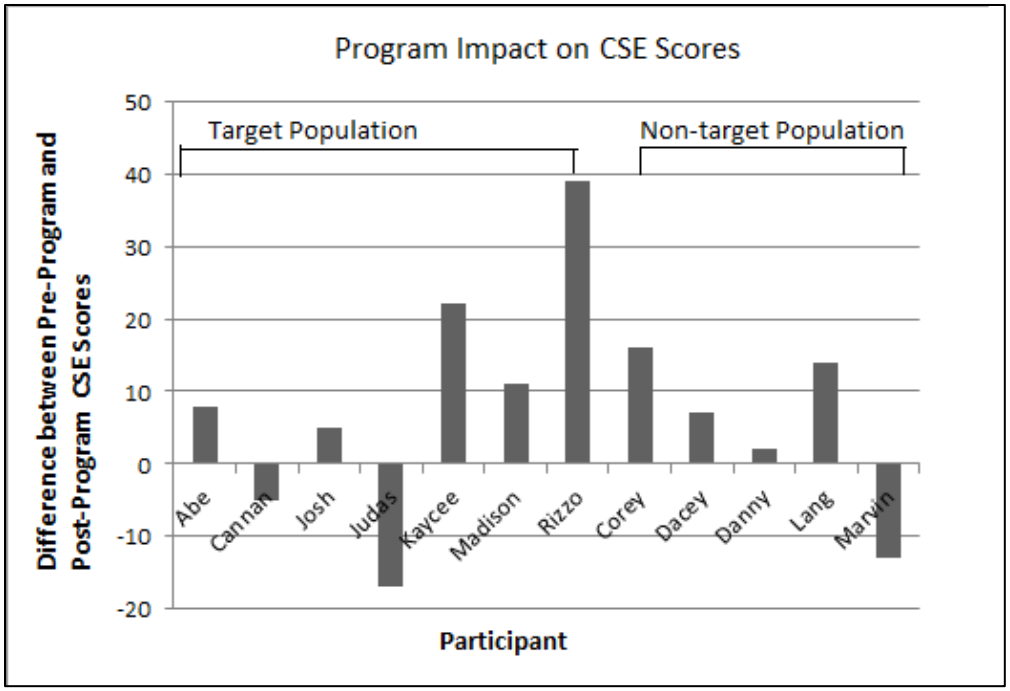

Figure 2: Program Impact on CSE Scores

Two out of the three participants whose CSE beliefs fell during the program were from the program's target population. The biggest changes in CSE beliefs were in Rizzo and Kaycee who were from the program's target population as well.

In summary, the statistical analyses indicated that while most of the participants experienced an increase in their CSE scores at the end of the program, the changes in CSE scores before and after the program were not statistically significant.

CASE DESCRIPTIONS

At least six months after program completion, some of the participants and their parents were interviewed by the researcher. Detailed case descriptions of those participants are now presented, and each case description includes the following sections:

a. *Background of Participant and Family:* This section describes the participant's family background and includes a discussion on their pre-program experience with computers as well as the motivation behind the participant's decision to participate in the CompNow program.

b. *Program Perceptions:* This section describes the perceptions shared by the participant and his/her family about the CompNow program, the after-school sessions conducted at the participant's school as part of the program, as well as the program materials provided and presented to the participant during those sessions.

c. *Impact of Program on Computer Self-Efficacy (CSE):* This section provides an answer to the following research question: How did participation in the program affect students' self-efficacy beliefs in their computer skills? It captures both the pre-program factors affecting the participant's CSE scores and the factors affecting the post-program CSE scores. The section concludes with a discussion of the CompNow program's impact on the participant's CSE beliefs.

d. *Impact of Change in Computer Self-Efficacy on Home Computer Use and Family:* This section provides an answer to the following research question: How did the change in computer self-efficacy beliefs in participants impact their usage of computer and Internet connectivity in their homes? This section also discusses how the participant's computer and Internet literacy (21st Century skills) were impacted by the change (if any) in the participant's CSE beliefs at the end of the CompNow program.

e. *Impact of Computer and Internet Connectivity on Participant and Family:* This section provides an answer to the following research question: How has

the introduction of a computer and Internet connectivity into the learners' homes impacted the learners and their families? It includes a discussion of the experiences of participants and their families with the computer hardware, software, and Internet connectivity provided by the CompNow program. An analysis of the impact of the software skills learned during the program is also presented.

The case descriptions of participants who were considered to be from the program's target population by the researcher are presented first; they include Josh, Kaycee, Madison and Rizzo. They are followed by participants who were considered to be from the program's non-target population by the researcher and include Corey, Dacey and Danny.

CASE ONE: JOSH

Background

Josh, a Hispanic male, was an 8th-grade student living with his mom, an older sister (age 15 years), and a younger sister (age 4) when he attended the CompNow program. He was born in TexTown in 1995 and went to a TexTown-based elementary and middle school. In the future, he wanted to attend the same area high school his elder sister was currently attending. Although Josh was unsure about which college he would like to attend, he definitely wanted to attend college and was interested in taking pre-AP classes during high school. He felt he was a good soccer player and planned to study auto mechanics because he liked cars.

Josh's family predominantly spoke Spanish at home, but Josh was very comfortable speaking English as well. Josh's mom earned a living by cleaning houses

and rarely used computers. Josh and his elder sister were the major users of their home computers, but his mom had only limited computer awareness. At the beginning of the program, Josh's family had one desktop computer in the house which was shared by all family members. They had no Internet service in the house at the beginning of the program. Josh used to use the computer for about an hour on a daily basis and felt he would have used it more if the computer were faster and if his elder sister were not "always" on it. Josh primarily used the computer for playing games and music. Josh knew enough about computers before the program to be able to fix the family computer when it broke down. He was also able to clean the computer by reformatting the infected hard disk after it became infected with a virus.

Josh initially heard about the CompNow program from one of his middle-school teachers when he was in 7th grade. He was not interested in the program at that time but became interested when he was in the 8th grade. He knew that the company, whose brand name was associated with the CompNow program, was a big company and that was a key factor in motivating him to join the program. He also wanted to learn about computers and to be able to fix his own computer when needed. His mom knew about the company as well and supported his decision to join the program. Josh was the only participant interviewed by the researcher who was motivated to join the CompNow program because he knew the computer company whose brand name was associated with the program.

Program Perceptions

Josh liked the program but found it too easy and thought the program was best suited for beginners in computers. He liked the hands-on portions of the program but was interested in a similar but more challenging program. His mom also liked the program and wished she could participate in a similar program to learn about computers. She enjoyed her son's participation in the program and expressed a desire for additional opportunities to help Josh continue his computer education as illustrated by her quote below:

> I really enjoyed my son taking the class and really enjoyed seeing him learn a lot and I want him to continue to learn more about computers. (Interview, 3/23/2010, Public Library close to Josh's school)

Josh said the program was fun and indicated he would recommend the program to other students.

During the interview, Josh and his mom shared their perceptions about the class and the workbook used in the program. Josh felt the classes were good in general and learned some facts about computers, as illustrated in his reflections in the program workbook:

> I have learned what some of the Drives are. One of the drives is the hard drive. It stores data like music, videos and other important documents. Another drive is the CD drive or DVD drive. It plays CD's or DVDs or it can read data from CD's. I'm learning where most of the hardware goes. I also learned that the best way to make your computer go faster is to upgrade the RAM memory and the hard drive. (Reflective notes in Josh's CompNow Program Workbook, 3/9/2010, After-School CompNow Program Session at Josh's school)

The portions of the CompNow program sessions where Josh had hand-on experience with the computer and examined its inner-workings were the most interesting for him. He felt

hands-on learning was the easiest. When asked for his perceptions of the program workbook, Josh said he had not used it since the program's completion. He felt the program sessions were well-organized and students were excited to be in the CompNow program.

Impact of Program on Computer Self-Efficacy

Josh had pre-program CSE score of 164 out of 180 points (program mean: 136.08) and a post-program CSE score of 169 out of 180 points (program mean: 143.5). Factors which likely affected these scores are discussed in the sections below, followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Prior to the program, Josh's family had an old computer in their home which used to break down often and was shared by Josh and his sister. He also had adequate computer knowledge to be able to fix the computer when it had problems and wanted to learn more about computers during the program. His family did not have a strong background in computers but was supportive of his interest in computers. Josh's higher perception about his CSE beliefs at the beginning of the CompNow program (in comparison to other program participants) could, therefore, be attributed to his pre-program experiences with computers as well as his family's strong support of his computer interests.

Program Factors Affecting Participant's CSE

Throughout the program, Josh maintained a strong interest in learning about computers, worked very well with his peers, and completed the program exercises related to computer literacy. He was an active participant in the program and spoke up whenever he knew something about the topic being discussed in a session. Furthermore, during the

CompNow program sessions, he paid attention to the instructor's demonstrations on the computer. He was able to complete successfully the test relating to the disassembly and reassembly of the computer hardware and also installed an additional 512 MB RAM during the program. He successfully installed Windows Operating System on the computer and completed the software-related exercises as well. Josh was, therefore, able to experience modeling of computer activities by the instructor; had successful hands-on experiences with computer hardware, software, and Internet; and received positive feedback from the instructor and peers during the program. These factors appear to have contributed to his post-program CSE score being the highest in the program. Additional details of Josh's experiences during the program are presented below.

Modeling and Hands-on Experiences

During the program, Josh was studious, quiet, and attentive in the class but spoke up when he knew something about the topic being discussed. This researcher once observed him talk about DVD decoders in class. Josh also observed the program instructor very closely when demonstrations were conducted on the assembly and disassembly of computer hardware, computer software operations, and the Internet. He wrote the following in his workbook after completing the hands-on exercise to disassemble and re-assemble the computer:

> I learned where the ribbon cables go. I learned how many RAM slots my computer has. I also learned how many GB my hard drive has. I also learned which cables are the Power cables. I learned where my CPU is in my computer [sic]. I also learned where my floppy disk would go but I don't have one [sic]. I learned where my power supply goes. I also learned where my fan was. I can't wait till we get started on software. I want to load a lot of programs on my computers. I also learned where are the extra bays [sic] I want to add a graphics card. So that's what I learned today. (Reflective notes in Josh's CompNow Program Workbook, 3/3/2010, After-School CompNow Program Session at Josh's middle school).

During the program, Josh completed computer hardware literacy-related exercises which included multiple-choice questions, filling in the blanks, and drawing the front and back of the computer. He also installed a new CD player on the computer during one of the sessions. Furthermore, he expressed a strong interest in learning about software as illustrated by his writing in the program workbook just before the software-related sessions began:

> I can't wait till we start learning about software. I want to learn how to make my computer safer for me like when I surf the Internet. I also want to learn the different kind of software there is for computers [sic]. I want to install a video card to my PC. I also want to install a sound card. I want to install iTunes and Windows media player. (Reflective notes in Josh's CompNow Program Workbook, 3/10/2010, After-School CompNow Program Session at Josh's middle school).

Josh demonstrated his software knowledge by installing Windows operating system on his computer and by completing the software exercises on MS Paint, MS Word, MS Excel, and MS Power Point. He asked questions about the creation of the Apple operating system during a discussion about operating systems. During the Internet sessions, he also inquired about diverse topics such as a line feed from space, orbit, rogue satellites, nuclear bombs, and Japan. Josh, however, did not complete many of the Internet-related exercises which required the use of a search engine to find facts and images on the Internet.

Family Support during Program

Josh took the time to discuss what he had learned about computers with his mom during the CompNow program sessions. His mom supported his participation in the program and encouraged him to attend the program consistently. Josh's attendance records indicated he did not miss any program sessions.

Computer and Internet Literacy

The CompNow program enabled Josh to become more computer and Internet literate by discussing computer and Internet terminology during program sessions among peers and with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, a key 21st-century skill. The data analysis indicated that Josh comfortably discussed Windows Operating System in one of the CompNow program sessions with fellow participants and used computer terminology such as CD-ROM, DVD player, mother board, graphics card, video card, and so on, during his interview with the researcher. He also installed a new CD player on the computer during one of the CompNow program sessions in addition to installing Windows operating system on his computer and completing the software exercises on MS Paint, MS Word, MS Excel, and MS Power Point.

Program's Impact on CSE Beliefs

Josh scored 164 (maximum score: 180) points in the Computer Self-Efficacy Questionnaire administered before the program. This score was higher than the mean score of 136.08 for the class and was also the highest in the program. At the end of the program, Josh scored 169 in the Computer Self-Efficacy questionnaire which was not only higher than the class mean score of 143.5 but was also the highest score in the program. His score increased by 5 points at the end of the program which converted to a 3.13% increase in his score as a result of the program.

The data showed Josh had high CSE beliefs at the beginning of the program that were sustained by his program experiences. The data analysis indicated his positive

demeanor in class, interactions with program instructor and peers, and hands-on experiences during the program further contributed to a slight enhancement in his CSE beliefs.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

More than six months after the program's completion, the researcher found that the slight increase in Josh's CSE beliefs was reflected in his statement that he learned a bit more about computers in the program and became more comfortable working with personal computers after completing the CompNow program. He felt he already knew a lot about computer hardware and software but learned a bit more about computers during the program. Josh felt computers were fun and that time flew when he was on the computer. He also felt it was somewhat important for him to work with computers in his everyday life. Josh expected to be using computers in the future and said when he had some spare time, he would like to build a computer with a customizable mother board, thus demonstrating his strong CSE beliefs. He also hoped to take up a computer-related job in the future involved building software.

At his high school, Josh had reviewed a computer class offered at the school but did not take it as he felt he already knew the software being used in that class. He was more interested in a school program in which he could learn about computer maintenance and repair.

Josh had also implemented several upgrades to his computer which reflected his high CSE beliefs. As mentioned earlier, he had added 512 MB of RAM as well as a new CD-ROM drive while participating in the program. After the program, he added a graphics card to the computer so he could switch cards while playing computer games.

He also added a wireless Internet card to enable him to use the high-speed Internet service at home. Additionally, he was attempting to install more memory to the computer at the time of the interview. The time he spent on his computer had also increased from about an hour to three hours daily.

Impact on Family

Josh's mom said she developed an interest in computers by watching Josh work with them and expressed a desire to learn more about computers herself. Josh helped his mom begin using the computer and continued to assist his elder sister whenever she needed help with computer issues. He felt his younger sister was then too young to use the computer. He was in touch with a few other CompNow program participants as they currently attended his high school, but he had not discussed the program with them. He met with the program instructor once after completing the CompNow program when he visited his middle school. It was mentioned that while the non-program computer was in the family living room, the CompNow program computer was in Josh's room, thus indicating the family's confidence in his abilities to make proper use of the computer.

Summary of CSE Impact

In summary, the data analysis indicated Josh's slight increase in his CSE beliefs after completing the CompNow program resulted in his increased confidence in using computers. His high CSE scores were reflected by his ability to add a graphics card to his computer on his own in addition to helping his mother develop an interest in computers.

Impact of Computer and Internet Connectivity on Participant and Family

The researcher discussed Josh and his family's experiences with the program computer to understand the impact of computer hardware, software, and Internet

connectivity provided by the program on Josh and his family. The impact of the software skills learned during the program was also analyzed by the researcher.

Computer Hardware

The data indicated that the CompNow program computer had a positive impact on Josh and his family, although Josh perceived the computer to be of poor quality and outdated. Josh's mom felt the computer was useful and indicated the family would not have been able to afford a separate computer for him. Josh felt the computer was working fine and preferred the program computer to the other home computer, not only because the program computer was his personal computer, but also because the family computer was rather slow and had to be shared with his siblings. Josh used to spend about an hour every day on computers prior to the program but increased his usage to more than three hours a day after completing the program.

Josh felt the CompNow program computer was of limited use due to its outdated technology and memory but had implemented some upgrades to enhance its capabilities and performance. Josh noted the computer came with only 1 GB of memory and was expensive to upgrade as it used an older type of memory. He felt the computer would have been more useful if it had more advanced hardware. He also felt the CompNow program computer's parts failed too quickly and that the graphics and software programs were not advanced enough to be useful.

Software Programs and Skills

Josh said he used the program computer primarily for play-related activities, including games and music. While the CompNow program helped him learn additional hardware skills, it did not provide any opportunity for him to learn and enhance his skills related to computer games and music. His elder sister used the family computer to

upload and edit photographs. Josh had not used any of the software included in the CD provided during the program. The results of the data analysis indicate that the software skills learned by Josh during the program as well as the software provided by the program did not make much of an impact on Josh and his family.

Internet Connectivity

The dial-up Internet service offered by the program was not used by Josh and his family because they obtained high-speed Internet service in their home after the program ended. Josh was able to connect the program computer to their Internet service by adding a wireless card and setting up the wireless connection on his own.

Summary of the Computer's Impact

The introduction of an additional computer in the house coupled with his high CSE beliefs enabled Josh to increase the amount of time he spent on the computer at home. Josh was able to circumvent the computer's hardware limitations by implementing several upgrades. The presence of an additional computer in the house also enabled Josh to help his mom learn about computers.

CASE TWO: KAYCEE

Background

Kaycee, a Hispanic female, was a 7th-grade student living with her mom when she attended the program. She was born in Honduras in 1994 and moved to TexTown when she was nine years old. She went to elementary schools both in Honduras and TexTown and was attending a middle school in TexTown during the program. Her future plans included a desire to attend an area high school like a number of her friends, but Kaycee could not do so because her family had moved to a different part of TexTown. Kaycee

wanted to go to college because she wanted to become "somebody" in life and make her parents proud. She planned on attending a large university in TexTown and wanted to pursue a career in cosmetology because she liked to cut and dye hair, do nails, work with people, and make friends.

Kaycee's family spoke Spanish predominantly but Kaycee was very comfortable conversing in English as well. Kaycee's dad was not living with them, while Kaycee's mom was frequently unemployed and worked low-paying jobs such as housekeeping. Kaycee's mom had completed fifth grade in Honduras; but she could not pursue her education in the U.S. as she was working constantly to earn a living. Kaycee's family had no computers and Internet service in the house prior to the program. Kaycee and her mom did not have much knowledge about computers, but Kaycee had used them occasionally at school.

Kaycee heard about the program from the program instructor while in school and became interested immediately because she wanted to learn about computers. She told her mom about her interest in joining the program, and her mom agreed right away because she, too, believed that Kaycee should learn about computers. Her quote was as follows:

> When she told me about it [the program], I knew she should learn about computers and agreed right away. (Interview, 11/15/2009, Kaycee's middle school).

Although she knew the program name contained a well-known computer company's brand name, Kaycee insisted that she only joined the program because she wanted to learn about computers. At the time of Kaycee's participation in the program, her mom was unfamiliar with the computer company or the brand, and only understood the

program consisted of computer classes. Kaycee's mom felt it was important for Kaycee to learn about computers and expressed a desire to learn about computers herself.

Program Perceptions

Kaycee mentioned she liked everything about the CompNow program and that she enjoyed the well-organized program. However, she also felt she would have liked to have had more hands-on activities during the program. She felt if she had not attended the program, she would not have been able to help other people with their computer problems nor would she have obtained a computer for home use. Her mom liked the program as well and said she really would have liked to participate in the program, too:

> I would have liked to be part of the class because I don't know how to use the computer and I still don't know how to use the computer and would have enjoyed the class. (Interview, 11/15/2009, Kaycee's middle school).

Kaycee and her mom indicated that Kaycee could not have obtained a computer of her own without the program and said they would recommend the program to others.

During the interview with the researcher, Kaycee and her mom shared their perceptions about the class and the program workbook. Kaycee enjoyed the classes and felt the classes were neither difficult nor easy, but were just right. When asked for her perceptions of the program workbook, Kaycee said she liked it and found it useful, as illustrated by her quote below:

> I liked them [sic]. I have it at home and it tells me what to do when I have a problem. (Interview, 11/15/2009, Kaycee's middle school).

Kaycee liked the hardware-related portions of the class better than the software-related portions and felt all the activities were well-organized.

Impact of Program on Computer Self-Efficacy

The data analysis suggested there were some pre-program factors which affected Kaycee's pre-program CSE score (114 out of 180 points, program mean: 136.08), and there were certain program factors which affected Kaycee's CSE score (136 out of 180 points, program mean: 143.5) at the end of the program. These factors are discussed in the sections below, followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Prior to the program, Kaycee had only occasionally used computers at her school and owned no computers at her home. She had moved from Honduras to the U.S. when she was nine years of age, and since then, her mom had held irregular jobs. Additionally, her family had no computer experience prior to the program. These factors seemed to have resulted in Kaycee's low perceptions about her computer self-efficacy at the beginning of the program.

Program Factors Affecting Participant's CSE

Kaycee joined the program because she wanted to learn about computers and because her mom believed Kaycee should learn about computers. She was generally quiet during the CompNow program sessions but maintained a strong interest in learning about computers and completed the program exercises related to computer literacy. She observed the instructor's demonstrations on the computer very closely and put in due diligence to disassemble and re-assemble the computer hardware. She completed the software-related and Internet-related exercises and also successfully installed the Windows Operating System during CompNow program sessions. Kaycee was, therefore, able to experience modeling of computer activities by the instructor and had successful

hands-on experiences with computer hardware, software, and the Internet. These factors seem to have contributed to the increase of 19.30% in her post-program CSE score. Additional details of Kaycee's experiences during the program are presented below.

Modeling and Hands-on Experiences

Kaycee was quiet during most of the CompNow program sessions but maintained a strong interest in learning about computers and completed the program exercises related to computer literacy. She paid close attention in class to the instructor's demonstrations on the computer and worked hard to complete successfully the test relating to the disassembly and reassembly of the computer hardware. She also completed computer hardware literacy-related exercises which included multiple-choice questions, filling in the blanks, and drawing the front and back of the computer. Additionally, she was able to install Windows Operating System successfully and complete the software-related exercises. Kaycee completed a majority of the Internet-related exercises which required the use of a search engine to find facts and images on the Internet. Kaycee was, therefore, able to experience modeling of computer activities by the instructor and had successful hands-on experiences with computer hardware, software, and the Internet.

Kaycee was also very studious during the CompNow program sessions. She took her time in getting things to work but persisted until she did so. She worked very well with her fellow participants and showed interest in learning about computer hardware. However, she did not complete any of the reflective writing exercises in the program workbook. This researcher did not observe her asking any questions during the program. She generally took a longer time than most other participants to complete her exercises but persisted and completed them.

Family Support during Program

Kaycee's mom believed Kaycee should learn about computers and supported Kaycee's decision to participate in the CompNow program. During the course of the program, Kaycee and her mom could not discuss much about her program activities because her mom had two jobs at the time and only had enough time to drive her to school and pick her up after classes. However, Kaycee's mom helped her attend the program regularly. The researcher reviewed her attendance records, and they indicated she did not miss any of the regular sessions.

Computer and Internet Literacy

The program enabled Kaycee to become computer literate. She also demonstrated considerable ICT literacy, a key 21st-century skill. During the program, she demonstrated her knowledge about computer hardware, software, and the Internet by completing the program exercises in the workbook. Additionally, she used limited computer terminology, such as DVD player and modem, during the interview with the researcher.

Program's Impact on CSE Beliefs

Kaycee scored 114 (maximum score: 180) points in the Computer Self-Efficacy Questionnaire which was administered before the program. This was lower than the mean score of 136.08 for the class and only two points higher than the lowest pre-program score in the class. At the end of the program, Kaycee scored 136 in the Computer Self-Efficacy questionnaire which was still lower than the class mean score of 143.5. Her post-CSE score had risen above four other participants' scores in the program. Her score increased by 22 points at the end of the program which was a 19.30% increase in her score due to the program. This represented the second-highest increase in CSE scores among all program participants. However, her post-program CSE

score remained lower than the program's mean score at the end of the program. The data analysis could not pinpoint the reasons behind her low post-program CSE score, but the researcher discusses some possibilities in the next chapter.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

The data analysis indicated that the significant increase in Kaycee's CSE had increased her confidence in computers more than six months after the program's completion. She stated she could fix any problems that might arise with the program computer and expressed interest in learning more about computer technologies. Kaycee was now using a personal computer at home every day.

Impact on Family

Kaycee's mom felt that after completing the CompNow program, Kaycee was always working on the computer and playing games. Kaycee asserted she could now help other people with their computer problems and mentioned an instance where she helped a teacher at her high school overcome problems connecting a computer to other devices in the classroom. Her mom felt good about this success and hoped these computer skills would help her daughter obtain a job involving computers in the future. Her mom indicated she herself would now like to learn how to use computers and felt it would have been beneficial to her if she had been able to participate in the program alongside her daughter.

Summary of CSE Impact

The data analysis indicated that the considerable increase in Kaycee's CSE beliefs, coupled with access to a computer at home, had a significant impact on Kaycee

and her family. Kaycee was using the computer every day, and her mom had also acquired an interest in learning about computers. Furthermore, the increase in her CSE beliefs had given Kaycee the confidence to help other people as illustrated by the assistance she provided to her high-school teacher in connecting a computer to other classroom devices.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The computer provided by the program had a significant impact on Kaycee and her family. The family did not have a computer prior to the program and felt that they could not have obtained a computer on their own without the program. The program computer was, therefore, the first computer in the household and was found to be very useful by Kaycee and her family. Kaycee felt the computer was working well and reported she had no problems with it, although she would have liked to have had a DVD drive on the computer. Kaycee had exclusive access to the program computer, because her mom did not know how to use computers. Kaycee used the computer primarily for play-related activities including games and creative writing. She had not made any hardware changes to the computer nor had she added or removed any software on the computer.

Software Programs and Skills

Kaycee said she used CDs to play computer games and had occasionally used MS Paint after completing the program. Kaycee had not yet used any of the software included in the CD provided by the CompNow program.

Internet Connectivity

Kaycee and her family did not have Internet service at their home. Although the program provided the option of utilizing free dial-up Internet service from a well-known local company, her family could not make use of it because they did not have a telephone line. Kaycee's mom said the following about her expectations regarding Internet connectivity:

> I would have been happy if the computer could be connected to the Internet, but there is no phone line at the house…. We would like to know how to get help to connect to the Internet. (Interview, 11/15/2009, Kaycee's middle school).

Kaycee's mom desired Internet connectivity, needed some help in setting up the Internet connection, but did not know whom to contact for assistance.

Summary of the Computer's Impact

As the first computer in the household, the computer provided by the program had a significant effect on Kaycee and her family. Although they had not experienced any problems with the computer, Kaycee and her family were hampered by the lack of a phone line to use the dial-up Internet service and lack of program assistance for establishing the dial-up connection after completing the program. These findings suggest that while the program enabled Kaycee and her family to have access to a computer at home when they could not afford to buy one, the Internet service was a disappointment to the family. The benefits of increased access to computers could have been greatly amplified by post-program support for Internet connectivity.

CASE THREE: MADISON

Background

Madison, a Hispanic female, was an 8th-grade student living with her uncle, aunt, and a cousin, two years her senior, when she attended the CompNow program. She was born in a small town located a few hours away from TexTown in 1994 and moved with her dad to Arkansas after her parents divorced when she was seven years of age. After attending elementary school in Arkansas, she moved back to her birthplace for a couple of years before moving to TexTown. She was attending a middle school in TexTown while participating in the CompNow program. In the future, she wanted to attend the same area high school as a number of her friends who were studying courses in Dance, Spanish, and Theater. Madison wanted to attend college at Harvard or UCLA and become a lawyer or a dentist. Her family was excited for her and felt she could be the first family member to graduate from college.

Madison and her family spoke Spanish predominantly, but Madison was very comfortable speaking English as well. Madison's uncle worked in construction and specialized in installing dry-wall. He learned computers in high school and was interested in them. The researcher could not ascertain the current occupation of Madison's aunt but did learn that she used computers occasionally. Madison's family had no computers and Internet service in the house prior to the program.

Madison saw a flyer about the program in school and was interested immediately because she wanted to learn about computers. She told her aunt about her interest in joining the program, and her aunt agreed right away. Madison had not noticed that the program contained a major computer company's brand name and also did not know until the program began that she would be able to take home a computer after completing the

program. She joined the program solely based on her interest in learning about computers.

Program Perceptions

Madison liked everything about the program and indicated that no changes were necessary including the materials, the classes, and the instructor. She felt the classes were easy but would not like them to be more challenging. She liked both the hardware- and software-related portions of the program. Madison and her aunt said she could not have obtained her own computer without the program as the family could not afford to buy one.

Impact of Program on Computer Self-Efficacy

The data analysis suggested there were some pre-program factors which affected Madison's pre-program CSE score (134 out of 180 points, program mean: 136.08) and that certain program factors affected Madison's CSE score (145 out of 180 points, program mean: 143.5) at the end of the program. These factors are discussed in the sections below and are followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Prior to the program, Madison's family had no computers in the home, and Madison had only occasionally used computers at school. Her parents had divorced when she was seven years of age; and she had moved to Arkansas for a brief period with her dad before settling down with her uncle and aunt in TexTown two years later. Her limited exposure to computers and limited parental support were factors that appeared to have contributed to Madison's low perceptions about her computer self-efficacy at the beginning of the program.

Program Factors Affecting Participant's CSE

Madison was generally quiet during CompNow program sessions but maintained a strong interest in learning about computers and completed program exercises related to computer literacy. She paid close attention to the instructor's demonstrations on the computer and successfully completed the test relating to the disassembly and reassembly of the computer hardware. She worked well with her peers in the program and was able to install successfully Windows Operating System on the computer in addition to completing the software-related exercises. Madison was, therefore, able to experience modeling of computer activities by the instructor and had successful hands-on experiences with computer hardware, software, and Internet. She also received feedback on her activities from her peers and discussed program activities with her aunt every day during her enrollment. Her aunt had been supportive of her participation throughout the program as well. The study suggests that these factors contributed to an increase in her post-program CSE score. Additional details about Madison's experiences during the program are presented below.

Modeling and Hands-on Experiences

During the CompNow program sessions, Madison was studious and attentive, worked very well with her fellow participants, and displayed interest in learning about computer hardware. She also completed computer hardware literacy-related exercises which included multiple-choice questions, filling in the blanks, and drawing the front and back of the computer. Madison was very happy after completing the hardware portions of the program and wrote the following reflections in her program workbook:

> I want to learn more about the parts inside of a computer. And how to fix it, if something breaks I can know what it is and fix it. I learned how to fix a computer. I could fix my friends' or other peoples' computers. People will hire me. I could get jobs in a company or I could be a technician. I could use it at

> home for my homework. Internet. Chatting. messaging. Getting information [sic]. (Reflective notes in Madison's CompNow Program Workbook, 3/3/2010, After-School CompNow Program Session at Madison's middle school).

Madison demonstrated her software knowledge by completing the software exercises on MS Paint, MS Word, MS Excel, and MS Power Point. Madison completed some of the Internet-related exercises which required the use of a search engine to find facts and images on the Internet.

Family Support during Program

Madison's aunt was supportive of her participation throughout the program, and Madison discussed the class computer activities with her aunt daily. During the program, Madison attended the sessions regularly with her aunt's help and support. Her attendance records indicated she missed one program session and subsequently attended a make-up session held before school started the next day to compensate for the absence.

Computer and Internet Literacy

The CompNow program enabled Madison to become more computer and Internet literate by discussing computer and Internet terminology during program sessions, among peers and with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, a key 21st-century skill. Madison's comments in the program workbook suggested she gained an understanding of how to work with the computer:

> When you reassemble or disassemble you have to put on an ESD on. If you don't have them on when you are in touching the parts you can get electrocuted. When you get the part out you have to label them if you don't know what they are. Make sure that you pull correctly or It can break. Probably there could not be a replacing part. When you reassemble you have to make sure you put the part where they go. If you don't put them where they go it could not work. You also have to make sure that they are all the way in. (Interview, 11/15/2009, Public Library close to Madison's middle school).

Madison did not use much of the computer terminology during her interview with the researcher but demonstrated her ICT literacy in class by completing the exercises and tests relating to the knowledge of computer hardware and software.

Program's Impact on CSE Beliefs

Madison scored 134 (maximum score: 180) points in the Computer Self-Efficacy Questionnaire administered before the program. This was slightly lower than the mean score of 136.08 for the class. At the end of the program, Madison scored 145 in the Computer Self-Efficacy questionnaire which was slightly higher than the class mean score of 143.5. Her score increased by 11 points at the end of the program which represented an 8.21% increase in her score because of the program.

In summary, the data showed Madison's CSE beliefs were enhanced by her program experiences and suggested that both her family's support and her own commitment during the program contributed to her increased CSE scores.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

The increase in Madison's CSE beliefs made her feel more knowledgeable about computers after completing the CompNow program. She also felt she had learned a lot about computers during the program. After the program, she felt computers were fun and that "time flew" while she was on the computer. She felt it was somewhat important to work with computers in her daily life. She also felt it was important for her to have a home computer in order to learn more about it and use it for a variety of purposes, including her school homework.

Impact on Family

After completing the CompNow program, Madison took the opportunity to describe how to build a computer to some of her friends. She did not mention helping or teaching other family members about computers during her interview with the researcher. Madison's aunt mentioned that the program computer was in the family living room as Madison and her uncle were sharing the computer. At the time of the interview, Madison was not involved in any computer-related programs at her high school.

Summary of CSE Impact

The data analysis showed that Madison's CSE beliefs which were enhanced during the program had generally increased her confidence in computers. After the CompNow program's completion, Madison was spending more time on computers and was able to discuss computer issues with her friends.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The computer had a positive impact on Madison and her family. Because it was the first computer in the household, it provided computer access to Madison and her family who could not afford to buy a computer. Madison felt the computer was useful and working and said she had no problems with it. She had connected a digital camera to the computer and downloaded pictures onto the computer. During the course of the program, she installed a CD player onto the computer but had not made any hardware changes after completing the program. She was planning to add anti-virus software and was waiting for her uncle to purchase this software.

After completing the program, Madison was using the computer 2-3 days a week for about two hours for both schoolwork and play. She used the computer after school

for her homework and projects, in addition to using it for visiting the MySpace website on the Internet. She shared the computer with her uncle who used it primarily for conducting Internet searches. Madison's cousin who lived with the family occasionally used the computer to play games.

Software Programs and Skills

Madison had put her recently-learned skills in the CompNow program relating to MS Office Suite to use the CompNow computer for her schoolwork and to browse the Internet. She had not installed the software provided on a CD by the CompNow program which included software that was equivalent to MS Office Suite.

Internet Connectivity

Madison and her family had high-speed Internet service at their home and consequently did not utilize the free dial-up Internet service provided through the program by a well-known local company.

Summary of the Computer's Impact

As the first computer in the household, the computer provided by the CompNow program had a significant effect on Madison and her family. The program enabled them to have access to a computer at home when they could not afford to buy one. In addition, the computer enabled Madison to work on her homework and pursue her online interests. The skills she learned during the program relating to MS Office and the Internet were helpful to her after the program as well.

CASE FOUR: RIZZO

Background

Rizzo, a Hispanic male, was an 8th-grade student living with his parents and two younger brothers (ages nine and four) when he attended the program. He was born in TexTown in 1995 and went to TexTown-based elementary and middle schools. In the future, he wanted to attend the same high school as his parents and take courses in Technology, Theater, and Automotive Technology. Rizzo's chosen career path reflected his wish to follow in his dad's footsteps by joining the courier company for whom his dad was working at the time of the interview.

Rizzo and his family spoke English predominantly, and the family was comfortable conversing in Spanish as well. Rizzo's dad worked at a courier company while his mom worked as an elementary school teacher aide. At the beginning of the program, Rizzo's family did not have a computer and Internet service, and the family used the computers at a nearby public library. Occasionally, Rizzo's family also used the laptop and Internet connection at the nearby residence of his maternal grandparents. Rizzo's parents both believed in computers – his dad felt computers were definitely important and expressed a strong desire to study computers; and his mom believed in exposing children to computers at a very young age.

Rizzo initially heard about the program from one of his middle school teachers and became interested when he was told he could earn a computer after completing the program. When Rizzo's parents heard about his desire to participate in the program to obtain a computer, they were initially skeptical that he could really receive a computer at the end of the program but decided to give him a chance. The following quote is from Rizzo's mom:

> I had heard about it, but I was like [sic] you will never be able to get into it, you will never be able to get in [sic], but I finally had to give in and give him the benefit of the doubt and said "all right, let's try it." (Interview, 11/15/2009, Rizzo's home).

When asked if the brand name of the computer company associated with the program was a factor in deciding to participate in the program, Rizzo and his parents responded that obtaining the computer was the main motivator.

Program Perceptions

Rizzo liked both the hardware- and software-related portions of the CompNow program sessions. He felt the software discussed in the program was adequate but particularly enjoyed the hands-on activity of taking apart the computer and putting it back together as illustrated by his quote below:

> It was like [sic]if something went loose, we went like what happened [sic], you open it up and say "oh ok", and look at something else and say, "oh, that's how you put it in here" and so you are not afraid to do stuff [sic]. (Interview, 11/15/2009, Rizzo's home).

Rizzo felt the program workbook was useful and interesting as it had words and pictures describing the computer parts. He also mentioned that he still had the workbook with him at home.

Rizzo said he liked the CompNow program in general and, in particular, liked the program instructor. Rizzo's dad was also pleased that the program instructor actually cared and took the time to work with the participants, as illustrated in his quote below:

> I was real happy that the teacher actually cared and took the time for the student. There are other programs where you ask the teacher a question and they say "ask me later". Whereas here, they actually stop the class, go back to the kid, help them out, and put a big smile on their face [sic]. We met the teacher at the graduation ceremony and, a lot of kids - they were all in a good place together. (Interview, 11/15/2009, Rizzo's home).

Additionally, Rizzo's parents indicated they appreciated the fact that program participants were required to attend a make-up session every time they missed a regular program session. They further stated that they liked all aspects of the program, it was of the correct duration, and would like the program not to change much so future participants could have the same program experience. Rizzo's parents felt they would not hesitate to recommend the program to others. Rizzo also felt the program was useful and reported telling one of his friends who did not join the program that he should have attended it.

Impact of Program on Computer Self-Efficacy

The data analysis suggested there were some pre-program factors which affected Rizzo's pre-program CSE score (130 out of 180 points, program mean: 136.08), and that there were certain program factors that affected Rizzo's CSE score (169 out of 180 points, program mean: 143.5) at the end of the program. These factors are discussed in the sections below and are followed by a discussion of the CompNow program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Prior to the CompNow program, Rizzo's family did not have a strong computer background because of his parents' occupations. His dad worked for a courier company, and his mom working as an elementary school teacher's aide. The family had no computers in the house when Rizzo decided to join the program. Rizzo occasionally used computers at the nearby public library and at his grandparents' residence located a short distance away from his home. These factors seemed to have resulted in Rizzo's low perceptions about his computer self-efficacy at the beginning of the program.

Program Factors Affecting Participant's CSE

Analysis of the interview data suggested that some key factors contributed to a 30% increase in Rizzo's CSE score at the end of the program. Rizzo maintained a studious and strong interest in learning about computers throughout the program and completed program exercises related to computer literacy. He paid attention in class to the instructor's demonstrations and was able to complete successfully the test relating to the disassembly and reassembly of the computer hardware. He was able to successfully install Windows Operating System on the computer and complete the software-related exercises. During the program, Rizzo's parents took an active interest in his progress and regularly discussed program activities with him. Rizzo was, therefore, able to experience modeling of computer activities by the instructor; had successful hands-on experiences with computer hardware, software, and the Internet; and received feedback from his parents during the program. These factors seem to have contributed to the big increase of 30% in his post-program CSE score. Additional details of Rizzo's experiences during the program are presented below.

Modeling and Hands-on Experiences

Rizzo was quiet and attentive during the CompNow program sessions. The researcher observed him as being very polite, raising his hand when he needed the instructor's help. He took care to observe the instructor's demonstration of computer hardware and software operations. He was keen to learn details about the computer hardware as noted in his workbook after completing the hands-on exercise to disassemble and re-assemble the computer:

> When you open your computer you must [not] connect ESD to any metal. The drives are not alike. I learned that your computer will not turn on if the RAM is not inside. The CPU Fan is going to be taken out as a class. When you take it

> apart, then you put it back together it is just opposite from what you read. You really don't have to take out the power supply. When your computer is continuously begging that means something is wrong! (Reflective notes in Rizzo's CompNow Program Workbook, 3/3/2010, After-School CompNow Program Session at Rizzo's middle school).

During the program, Rizzo completed computer hardware literacy-related exercises which included multiple-choice questions and filling in the blanks, in addition to drawing the front and back of the computer. Rizzo demonstrated his software knowledge by completing the software exercises on MS Paint, MS Word, MS Excel, and MS Power Point. Rizzo also completed all of the Internet-related exercises requiring the use of a search engine to find facts and images on the Internet.

Family Support during Program

Rizzo's parents took the time to ensure he attended the program sessions and were very involved during the course of the program. Rizzo's dad set reasonable expectations with Rizzo: he was not going to get the program computer in one day but should go to class, put in time, and do everything asked of him at the program. During the program, Rizzo attended the program sessions regularly as illustrated by his quote below:

> I was there throughout the program. And when I missed, I would go in the morning (next day) and then go to class. (Interview, 11/15/2009, Rizzo's home).

Rizzo's attendance records indicated he partially missed two of the regular sessions and subsequently attended make-up sessions held before school started the next day.to compensate for those absences. Rizzo's mom took the time to drop him off in the early mornings so he could attend the make-up sessions.

Computer and Internet Literacy

The CompNow program enabled Rizzo to become more computer and Internet literate by discussing computer and Internet terminology during program sessions among peers and with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, key 21st-century skills. During the program, Rizzo demonstrated his knowledge about computer hardware, software, and the Internet by completing the corresponding program exercises and tests. He also mentioned computer terminology such as CD-ROM, DVD player, RAM, etc. during his interview with the researcher.

Program's Impact on CSE Beliefs

Rizzo scored 130 (maximum score: 180) points in the Computer Self-Efficacy Questionnaire before the program. This was lower than the mean score of 136.08 for the class. At the end of the program, Rizzo scored 169 in the Computer Self-Efficacy questionnaire which was higher than the class mean score of 143.5. This was the highest student score, shared with only one other student. His score increased by 39 points at the end of the program which represented a 30% increase as a result of the program. Rizzo's increase in CSE scores was the highest among all program participants.

In summary, the data showed that Rizzo's CSE beliefs were enhanced by his program experiences and suggested that his family's support and his commitment during the program contributed to his enhanced CSE beliefs after the program.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

Rizzo's enhanced CSE beliefs after the program had a positive impact on his confidence in computers. Rizzo now felt it was important for him to have a computer to

accomplish and to learn even more. He also felt that using computers was a more enjoyable method of finding information than reading a book and that it was important to work with computers in his daily life. His dad felt he had learned a good deal about computers during the CompNow program as indicated by his quote below:

> I got real good feedback. He learned a lot, he was taught a lot. Going into the classroom, not knowing anything about computers, he now knows a lot about computers for his age. (Interview, 11/15/2009, Rizzo's home)

Rizzo also felt that, after the program, working with computers was easier than before the program. Moreover, he felt he could repair any computer problems which might arise.

Impact on Family

The analysis of the data indicated that the big increase in Rizzo's CSE beliefs had positively impacted his family's confidence in his computer abilities. Rizzo's mom commented after the program that Rizzo had become good with the computer and felt a lot more comfortable with it. She also felt that the more he was using the computer, the more he was learning about it. Rizzo's dad felt Rizzo did not give up when he encountered problems with the computer; but rather expressed confidence that Rizzo will be using the computer during high school to do his homework. He also felt Rizzo was interested in attending a computer-oriented college in the future. His mom mentioned that while the computer was in his parents' room for the first couple of months, it was moved to Rizzo's room as their trust in him with the computer increased. This is illustrated by her quote below:

> It started off in my room and it was there for a couple of months and then I started trusting him to be on it and so we got it to him. (Interview, 11/15/2009, Rizzo's home).

Rizzo's mom also mentioned that her parents (Rizzo's maternal grandparents) became more comfortable with Rizzo's use of their laptop once they realized how much he had learned through the program as described in her quote below:

> Once we got the computer and my parents saw how much he knew and saw how much he was learning, they let him start using their computer also. I think they became more comfortable knowing that he knew what he was doing instead of crashing the computer and whatever. They would let him use it before but once he had the course and told them and showed my dad how to use it, they said you know how to use it and they started to let him use it more often too. (Interview, 11/15/2009, Rizzo's home).

Rizzo's mom felt he helped her overcome her fear about computers and assisted her with her schoolwork as illustrated by her quote below:

> Rizzo has taught me a lot of things, because I am afraid of a lot of things, I am afraid I will do something wrong, mess up the computer, but they tell me "you can't mess it up Mom."
>
> I had recently started school and I was like, I don't know what I am going to do, so I get in and he was like "look this up, and you can find it" and I was like "ok" and so I looked it up and I found my school and at first I didn't know how to exit out of the test without losing the score, he figured that out for me and so he has been very helpful. (Interview, 11/15/2009, Rizzo's home).

Rizzo had positive feelings about helping his mom with her computer activities as illustrated in his quote below:

> Mmm, I feel pretty good, because that way when she needs to get something done, she can get it done. (Interview, 11/15/2009, Rizzo's home).

Rizzo also demonstrated to his Dad that he could solve computer problems as evidenced by this quote from his Dad:

> Like I said, I will give him a computer and I will be going what is wrong with it and leave it alone and he (Rizzo) will be going "no dad, hold on" and type

> something in it and it will come up. So, he has done very well and I am very thankful for the program. (Interview, 11/15/2009, Rizzo's home).

Additionally, Rizzo helped his maternal grandfather, a Disc Jockey, find music on the Internet and download it to his laptop. Furthermore, he helped his youngest brother perform computer-related activities and helped his friends edit their videos.

Summary of CSE Impact

The data analysis showed that Rizzo's CSE beliefs which were enhanced during the program had generally increased his as well as his family's confidence in his computer skills. After the CompNow program's completion, Rizzo was spending more time on computers and was able to provide increased computer assistance to family members.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The computer had a positive impact on Rizzo and his family as it was the first computer in the household. The CompNow program enabled access to a personal computer for Rizzo and his family who could not otherwise afford to buy one. Rizzo preferred having a computer of his own rather than having to go to the library and wait to use their computer. His dad agreed with Rizzo and felt it was convenient to have a computer at the house. His mom considered it a blessing to be able to get the computer through the program since they could never afford to buy a computer on their own, as illustrated in her quote below:

> That is the only computer we have and it was a blessing to be able to get that computer because we could never afford the computer before and we were always having to go to the library, waiting for hours, you know, you have to login, sign in there and wait there for a certain amount of time, before we could use it and that

> wasn't any fun at all, so it was a blessing to be able to get the computer with my son going into to CompNow. (Interview, 11/15/2009, Rizzo's home).

Rizzo's family of parents and three siblings shared the computer -- Rizzo's mom felt they were all getting a lot of use out of the computer. Their five-year-old played games with colors, numbers, and letters while the older children used the computer to work on school projects. Rizzo's parents were concerned the children might get "hooked" on the computer and thus focused on managing their computer usage time. They endeavored to ensure each child's computer time was limited to two hours and was not entirely spent playing video games. Rizzo's mom had recently enrolled in an online school to get an Associate's Degree in Child Development so she would be qualified to work as a classroom teacher rather than being limited to working as a teacher's aide. She used the computer to read course materials and prepare for knowledge assessment tests. Rizzo felt the computer was fine but slow and probably needed more RAM for increased speed.

Rizzo did not use the computer very much during the summer following the program's completion but had used the computer for about two hours per day since that time. He had not made any changes to the computer after completing the program but had accepted a working keyboard from his uncle to keep it as a spare part. Rizzo's parents and three siblings shared the computer and sometimes used it to upload pictures from their cell phone. Rizzo's dad felt it would be a good idea to provide a printer along with the computer.

Software Programs and Skills

Rizzo used the program computer primarily for play-related activities including games and videos as well as occasional use in his school homework. The software skills learned by Rizzo during the program as well as the software provided by the program

focused on imparting software skills related to MS Office Suite. These were useful for Rizzo during his schoolwork as well as when he helped his mom with her schoolwork.

Internet Connectivity

Rizzo and his family had no Internet service in their home. They could not utilize the free dial-up Internet service offered by the program from a well-known local company because they could not afford a telephone line and used cell phones in the home. The family formerly obtained Internet service from their cell phone provider but had to discontinue it due to high cost. Rizzo indicated he would go to his maternal grandparents' house when he needed to use the Internet.

Summary of the Computer's Impact

Rizzo and his family were able to obtain their first home computer from the program but could not utilize the free dial-up Internet service. Rizzo's CSE perceptions were considerably enhanced by the program as well.

CASE FIVE: COREY

Background of Participant and Family

Corey, a Caucasian male, was a 7th-grade student living with his parents and younger brother when he attended the program. He was born in TexTown in 1996 and attended TexTown-based elementary and middle schools. His future education goals were to attend an area high school with a good band program (his mom indicated he was in the middle-school band), attend The University of Texas, obtain a Master's degree in Criminal Investigation, and work as a member of a SWAT team.

Corey's family spoke English at home and had a strong computer background. His parents were conversant with computer operating systems including Macintosh,

Windows, and Linux and the differences between them, as well as email software and office software including Microsoft Office and Open Office. His mom had previously held a state government position involving extensive use of computers but was unemployed at the time of the researcher's interview. His dad worked for a large computer company in TexTown as a computer programmer. The family had high-speed Internet service in their home and Corey shared a Macintosh computer with his younger brother prior to the program. Corey's parents believed Corey should learn about computers and felt that, although Corey had not used computers much during middle school, it was important that he learn the working mechanics of computers.

Corey became interested in the CompNow program when Mr. Hal, the program instructor and science teacher at Corey's middle school, talked with him about participating in the program and receiving a computer after completing it successfully. Corey's mom was very interested in his participation in the program because she wanted him to obtain the computer – that was a strong motivator for program participation as illustrated by her quote:

> That [Corey receiving a computer at the end of the program] was a big factor. He spent like [sic] 40 hours on the program and was very excited about the computer and was very committed to the program. (Interview, 11/15/09, Corey's residence)

Corey was interested in creating video games and was keen on learning about computers. Although the program had a major company's brand name associated with it, the brand name was not a factor in Corey's decision to participate in the program. Corey was primarily motivated by his interest in learning about computers, while his family was excited that he would be able to obtain a computer at the end of the program.

Program Perceptions

During the interview, Corey and his parents shared their perceptions about the class, the workbook used in the program, and the program itself. Corey felt that the CompNow program's after-school training sessions on computer hardware, software, and the Internet were good in general, and he found the classes interesting. The sessions where he had hands-on computer experience and examined the inner-workings of the computer were the most interesting for him. He felt hands-on learning was the easiest method by which to learn about computers. With regard to the program workbook, Corey felt it was useful during the program but had not used it much since the program's completion. His dad indicated that Corey had taken the workbook out to review the contents while they were trying to connect the computer he had earned to their home's Internet.

While Corey mentioned that he liked the CompNow program, his dad held some reservations. His dad described his own initial computer-learning experience and recollected he had to hook the computer to the television; with only 1K of memory, he had to write code to make everything work. He further emphasized that while the program enabled students to learn some facts about computers, his son gained only superficial knowledge from the program as indicated in his quote below:

> It is like Cuban history, you memorize some things for the test and then later you ask what happened in 1846, and you are like [sic] "I don't know." (Interview, 11/15/09, Corey's residence)

Additionally, he felt that Corey only gained some hardware knowledge and reinforcement on the knowledge gained in the program was necessary. Additionally, he felt the program's duration was short but the program helped him understand the gaps in Corey's computer knowledge. Corey's mom was also interested in additional programs which would provide reinforcement of the learning he received in the original program. In summary, Corey liked the program, but his dad perceived it as a program which provided only superficial computer knowledge.

Impact of Program on Computer Self-Efficacy

Corey had a pre-program CSE score of 145 out of 180 points (program mean: 136.08) and a post-program CSE score of 161 out of 180 points (program mean: 143.5). Factors which likely affected these scores are discussed in the sections below which are then followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Corey had access to a Macintosh computer at home. His family had a strong background in computers, was very computer literate, and strongly believed Corey should learn about computers. Additionally, Corey wanted to participate in the program due to his strong interest in learning about computers. These factors, namely, access to computers, strong family computer background, and Corey's strong interest in learning about computers, likely enhanced Corey's pre-program CSE scores.

Program Factors Affecting Participant's CSE

The data analysis suggested that some factors during the program enhanced Corey's CSE beliefs at the end of the program. During the program, Corey experienced modeling of computer activities by the instructor; had successful hands-on experiences

with computer hardware, software, and the Internet; and received consistently positive feedback and support from his parents. His computer and Internet literacy were enhanced as well. These factors are now discussed in greater detail.

Modeling and Hands-on Experiences

During CompNow program sessions, Corey paid attention to the instructor's computer demonstrations and completed all hands-on activities. In addition to maintaining a strong interest in learning about computers, he completed the program exercises related to computer literacy.

Corey was generally quiet during the CompNow program sessions but demonstrated enthusiasm in learning about computer hardware. He completed computer hardware literacy-related exercises which included drawing the front and back of the computer, answering multiple-choice questions, and filling in the blanks. He showed interest in the use of tapes for storage, asked questions about hard-disk defragmentation, and also inquired about its impact on performance. Additionally, he was able to successfully complete the hardware test that included the disassembly and reassembly of the program computer. He wrote the following in his workbook after completing the hands-on exercise to disassemble and re-assemble the computer:

> Today we took apart our computers. I took apart my computer and put back [sic] together & when I turned it on, it still worked. Two pods on my USB ribbon were bent. CompNow is fun. I want to learn about the software programs. Can't wait to take the computer home. (Corey's workbook, April 2009, Program session at middle school)

It was evident that Corey enjoyed working on the computer hardware during the program and was looking forward to taking it home.

Corey demonstrated a strong interest in software. He demonstrated his software knowledge by installing a Windows operating system on his computer and by completing all software exercises conducted during the program. These included exercises on MS Paint, MS Word, MS Excel, and MS Power Point. In class, the researcher also observed his asking questions about what viruses were and why Windows software was originally called "3.1.". Corey also demonstrated his Internet knowledge by using the Google search engine to visit websites and find facts and images needed to complete program exercises relating to the Internet.

Family Support during Program

Corey's parents were involved in his progress during the CompNow program and ensured he attended all sessions. During the program, his dad was aware that Corey had some scheduling conflicts, and his mom added that he participated in band and football on some afternoons, thus forcing him to miss some classes. Corey's attendance records indicated that he partially missed four of the regular sessions and subsequently attended make up sessions held before school started the next day to compensate for those absences. Corey's mom took the time to drop him off early in the mornings so he could attend the make-up sessions.

Computer and Internet Literacy

The CompNow program enabled Corey to become more computer and Internet literate by discussing computer and Internet terminology during program sessions among peers as well as with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, a key 21st-Century skill. During the CompNow program sessions, he demonstrated knowledge about computer hardware, software, and the Internet by completing the workbook

program exercises. Additionally, he discussed computers with his dad at home, mentioned computer-related terminology frequently during his interview with the researcher (such as CD-ROM, DVD player, mother board, etc.), and conversed about software such as Adobe Reader and operating systems, including Windows and Mac OS, both during the interview and during in-session program activities.

Program's Impact on CSE Beliefs

Corey scored 145 (maximum score: 180) points in the Computer Self-Efficacy Questionnaire administered before the program – this was higher than the mean score of 136.08 for the class. At the end of the program, Corey scored 161 in the Computer Self-Efficacy questionnaire which was higher than the class mean score of 143.5. His final score increased by 16 points which represented an 11% increase in his score due to the program. In summary, the data showed that Corey's CSE beliefs were enhanced by his program experiences. Furthermore, the data suggested that his family's support and commitment during the program, in addition to the enhancement in his computer and Internet literacy, were contributing factors to his enhanced CSE beliefs at the end of the program.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

The increase in Corey's CSE beliefs illustrates Corey's enhanced confidence in working with computers more than six months after the program's completion. Corey indicated he was more comfortable working with personal computers after the program and was not as comfortable working with the Macintosh computer at his home, thus leading the researcher to conclude that the program enhanced his comfort level with Windows-based computers. Although Corey admitted that his younger brother knew

more about the Macintosh computer than he did, Corey felt his computer abilities equaled those of his friends. He stated a desire to write programs for computer hardware in the future and was confident that if he obtained a computer-related job, he would be able to perform such a job successfully. His time spent on computers had also increased from about an hour every day prior to the program to about two hours every day after the program. When asked if daily tasks would be easier to accomplish using computers, Corey felt computers were not essential for all daily tasks. Additionally, he expressed a desire to participate in more programs involving computers.

Impact on Family

Corey's enhanced CSE beliefs and the resultant increase in his comfort level with computers gave him the confidence to help his younger brother use the personal computer and change some program settings on that computer. He also collaborated with his dad in trying to connect the computer to the Internet but was unsuccessful due to hardware limitations. Furthermore, he worked with his dad to add an additional CD-ROM drive to the computer.

The researcher was interested in understanding whether Corey's enhanced CSE beliefs had an impact on his parents' perception of his computer skills, knowledge, or usage. The researcher found they trusted Corey enough to place the program computer in his room but still considered his brother as knowing more about computers than Corey. During the interview, Corey's dad made a comparison of computer usage between Corey and his younger brother and indicated that Corey would probably stop at using the computer for entertainment purposes, while his younger brother would do more with his computer. When asked as to which family member knew the most about computers, his dad felt that he himself knew the most about computers. His mom felt that between the

siblings, Corey's younger brother probably knew more about computers and used computers artistically for music and comics. She also felt that whenever she asked a question about computers, Corey's younger brother seemed to possess the greater knowledge.

Summary of CSE Impact

In summary, the data analysis found that the increase in Corey's CSE beliefs during the CompNow program resulted in his increased use of the home computer and in his increased confidence in working on computer-related activities with his family. Although his family felt his younger sibling probably knew more about computers, they trusted Corey enough to place the personal computer in his room.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The computer provided by the CompNow program did not have a strong, positive impact on Corey and his family because it was perceived to be outdated, dysfunctional, and required costly upgrades to retain its utility. Corey felt the graphics were slow and he was unable to add hardware such as an additional CD-ROM drive to the computer. Corey added he had been in touch with a few of his fellow participants in the CompNow program since completing it and indicated they shared his perception that the computer was not very useful.

During a discussion on the use of the program computer, Corey and his parents mentioned that the Macintosh computer (shared by the family prior to the CompNow program) was used most of the time, even after receiving a computer from the program. Corey's mom indicated that although they were initially excited to participate in the

program and enable Corey to obtain a computer, they were disappointed to discover that the computer was not very functional, as indicated in her quote below:

> That was the exciting part, to be able to get the computer, put it in his room and have Internet. But when we got it home, it was so limited and not very functional. (Interview, 11/19/09, Corey's home)

Corey's dad referred to the computer's maintenance costs and said that the cost of adding memory was expensive enough for him to consider buying a new computer rather than adding memory to the program computer. He made the point that even when they wanted to add memory, the computer had other issues which prevented them from doing so and that using the computer with limited RAM for any practical purpose was not possible. Additionally, he opined that since the computer was a refurbished one, the program organizers could have put in an operating system that did not require as much memory. He felt a Linux-based operating system would have been less taxing on the computer and also indicated he unsuccessfully tried to install a UNIX-based operating system. Corey's mom felt students might be more familiar with a Windows-based system than a Linux-based system.

Software Programs and Skills

The software skills learned by Corey during the program, as well as the software provided by the program, focused on imparting software skills related to MS Office Suite and did not make much of an impact on Corey and his family. Corey used it primarily for play-related activities including games, multimedia, uploading of photos, uploading of videos and transferring them to You Tube. He only occasionally used computers for his schoolwork. Corey used the CD provided in the program to look up a couple of

programs as well, but he did not use it much otherwise. The program did not provide any opportunity for Corey to learn and enhance those skills.

Internet Connectivity

The slower dial-up Internet connectivity provided by the program did not provide any advantages over the high-speed Internet service already existing in Corey's home and, therefore, was not utilized by the household. The savings from the dial-up Internet service were not enough to motivate Corey and his family. Corey's dad felt it would be better if the program provided high-speed Internet connectivity instead of dial-up Internet service.

Summary of the Computer's Impact

In summary, the data analysis indicated that the presence of a pre-program home computer with high-speed Internet service, Corey's enhanced CSE beliefs and computer literacy levels, and his parents' high computer literacy exposed the limitations of the computer provided by the CompNow program. The presence of high-speed Internet service in the house greatly reduced the chances of Corey and his family utilizing the slower dial-up Internet service provided by the CompNow program. Results of the data analysis also indicated that these factors resulted in the general lack of impact of the program computer and dial-up Internet service on Corey and his family.

CASE SIX – DACEY

Background

Dacey, an African-American, was a 7th-grade student living with his mother, elder brother, and grandmother when he attended the program. He was born in TexTown in 1996 and attended a TexTown-based elementary school and middle school. His future

education plans included a desire to attend a magnet high school in his area, attend the Massachusetts Institute of Technology; and become a marine biologist, architect, or engineer.

Dacey's mom had worked as a cashier prior to the program but had quit her job sometime after the program was over due to problems at the workplace. She was unemployed at the time of the interview. Dacey's family spoke English at home and had some exposure to computers and related technology. Dacey's brother had previously participated in an earlier edition of the Hi-Tech CompNow program and obtained a desktop computer. However, this computer became unusable shortly thereafter, as it crashed and could not be rebooted. At the beginning of the program, Dacey, his brother, and mother shared a laptop and used it primarily for browsing the Internet and recreational purposes. They also had high-speed Internet service at their home.

Dacey frequented a public library located very close to his home to use its computers. Dacey's mom indicated this in her own words:

> He will be here all day, just so he can get a chance to get on the computer. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

As often as possible, Dacey would meet with one of his nephews who owned a computer so he could use and play on his computer as well. In other words, Dacey would access a computer whenever and wherever possible and was on the family's computer as much as possible on a daily basis. Dacey's mom believed in his computer abilities, felt his future would involve computers, and said that Dacey wanted to work with electronics to become a scientist of some sort.

Dacey was aware that his brother had participated in the program two years earlier and found it enjoyable. He had a strong interest in joining the program at the earliest opportunity, as he wanted to get a computer of his own. When Mr. Hal, the program instructor, told him about the program, he discussed it with his mom who was initially unsure whether he would really get a computer at the end of the program. She was convinced when he explained he would be building a computer which could be brought home after the program's completion. His mother also felt that, at the very least, the program would keep Dacey off the streets after school as illustrated in her quote below:

> I was like [sic]I don't know if he was going to get a computer or not, and said you are probably not going to get it, but he was like [sic], no, we will have to build it out there and I was like [sic]really, maybe it will be all right. At least, he will be no trouble on the streets. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

Although the program had a major computer company's brand name associated with it, Dacey and his family were primarily interested in obtaining the computer and did not pay much attention to the brand name associated with the program.

Program Perceptions

Dacey's mom liked the CompNow program and thought it could be enhanced to provide a venue for its graduates to volunteer and provide computer assistance to future program participants. She also felt a similar program should be set up in high schools to provide continuity in the learning process, as illustrated in her quote below:

> That would be nice. Like, [sic] donate theirs back so that the younger ones can work on that one and they could volunteer their help at that program with the kids in the future and help the middle school kids get a computer for those who don't have because I feel that a lot of kids are neglected on that issue. Parents don't

> have or cannot afford or understand – I have been there. And you know, I don't think I will be this far because you know they graduated, built the computer together [sic]. I think it will be awesome. Donate the computer that they built and let the younger ones have it. And then have another program in high school. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

She believed such a program could help parents who cannot afford and/or do not understand computers.

In summary, the program was perceived as a good one by Dacey and his family. His mom was thankful it kept her son occupied after school and gave him an avenue for learning more about computers. She suggested CompNow develop additional ways in which participants could continue their computer learning and also volunteer to help in subsequent editions of CompNow programs.

Impact of Program on Computer Self-Efficacy

Dacey had a pre-program CSE score of 144 out of 180 points (program mean: 136.08) and a post-program CSE score of 151 out of 180 points (program mean: 143.5). Factors which likely affected these scores are discussed in the sections below and are subsequently followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Prior to the program, Dacey's brother had participated in an earlier edition of the program and had received a computer (this computer was, however, not in working condition at the time when Dacey participated in the program). Dacey's mom did not have a computer-related background but owned a laptop which was shared by the family. Dacey had tremendous enthusiasm for computers and took advantage of every possible opportunity to work on a computer. He had prior experience working on his brother's

computer and his mom's laptop, as well as his nephew's computer. Additionally, Dacey wanted to participate in the program because he had a strong interest in obtaining a computer of his own. The data therefore suggested that Dacey's exposure to computers, strong interest in computers, and family support were factors which had a bearing on Dacey's above-average score in the CSE questionnaire.

Program Factors Affecting Participant's CSE

The data analysis suggested that some factors during the program enhanced Dacey's CSE beliefs at the end of the program, even though he had occasional behavioral issues during the program. Dacey maintained a strong interest in learning about computers throughout the program and completed program exercises related to computer literacy. Dacey paid attention to the instructor's computer demonstrations and was able to complete successfully the test relating to the disassembly and assembly of the computer hardware. He was also able to successfully install Windows Operating System and complete the software-related exercises. Dacey was, therefore, able to experience modeling of computer activities by the instructor and had successful hands-on experiences with computer hardware, software, and Internet. These factors seemed to have contributed to the 5.56% increase in Dacey's CSE score at the end of the program. His score continued to be higher than the mean CSE score as well. Additional details about Dacey's experiences and CSE-enhancing program factors are presented below.

Behavioral Problems

During the CompNow program sessions, the researcher observed at least one instance when Dacey was asked to be quiet after interrupting the instructor several times. He had previously received warnings for other acts of misbehavior during program sessions. At another CompNow program session involving the creation of presentations

and documents using MS Office software at the computer lab, Dacey collaborated with two other program participants, Marvin and Shawn, to delete another participant's (Lang's) documents on the program computer server. The program instructor worked with the school's web administrator to identify the student responsible for these unauthorized deletions and determined that Shawn had done it. Dacey, therefore, was given only a warning. The researcher was present at the school web administrator's office while this determination was being made at which time the web administrator reported that Dacey had previously been involved in these kinds of activities in other classes (not related to the CompNow program) as well. The researcher was unable to determine whether Dacey's behavioral issues affected his CSE scores at the end of the program.

Modeling and Hands-on Experiences

During the program, Dacey completed a computer hardware-related exercise that involved drawing the front and back of the computer. He practiced the disassembly and assembly of computer hardware and successfully completed the hardware test which included the disassembly and reassembly of the program computer. He had a strong interest in software and demonstrated his software knowledge by installing Windows operating system on his computer and by completing all the hands-on software exercises on MS Paint, MS Word, MS Excel, and MS Power Point. Dacey also used the Google search-engine to visit websites and find facts and images needed to complete program exercises relating to the Internet.

Family Support during Program

Dacey's mom encouraged him to attend the program regularly. During the interview, she noted that the family's residence was located in close proximity to both the

school and the public library, enabling Dacey to access public computers available at the library as well as to attend school conveniently. This proximity also enabled Dacey to attend the early morning make-up sessions for the CompNow program which were required for students who missed the regular sessions. Dacey's attendance records indicated he missed two sessions but subsequently attended make-up sessions held before school started the next day to compensate for those absences.

Computer and Internet Literacy

The CompNow program enabled Dacey to become more computer- and Internet-literate by discussing computer and Internet terminology during program sessions among peers and with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, a key 21st-century skill. During the CompNow program sessions, he demonstrated his knowledge about computer hardware, software, and the Internet by completing the exercises in the workbook. However, he did not complete any of the workbook's essay-writing exercises. At home, he was comfortable connecting the computer to other devices such as the iPod and his mother's laptop.

Program's Impact on CSE Beliefs

Dacey scored 144 (maximum score: 180) in the Computer Self-Efficacy Questionnaire administered before the program which was higher than the mean score of 136.08 for the class. At the end of the program, Dacey scored 151 in the Computer Self-Efficacy questionnaire which was higher than the class' mean score of 143.5. His score increased by 7 points after the program which converted to a 5.56% increase in his score.

In summary, the data analysis showed Dacey's CSE beliefs were enhanced by his program experiences. Results of the data analysis suggested that his occasional

behavioral problems resulted in slightly-reduced levels of engagement in the class activities; but his commitment to the program coupled with his family's support and encouragement during the program contributed to his enhanced CSE beliefs after the program.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

More than six months after the program's completion, the researcher found that Dacey continued to work confidently and comfortably with computers. Since Dacey was working comfortably with computers prior to the program, his CSE scores were higher than the mean both before and after the program, and his post-program CSE score increased marginally after the program, the researcher could not ascertain the impact of his post-program change in CSE beliefs on home computer use after the program.

Impact on Family

Dacey's enhanced CSE beliefs and the resultant increase in his comfort level with computers gave him the confidence to provide computer assistance to his mom. Dacey's mom indicated that she utilized his help whenever she had computer issues. She also said she did not know much about computers, and that Dacey taught her a lot about them, as illustrated in her quote below:

> Dacey is very computer literate. He is pretty much teaching a lot of stuff [sic]. I don't know how to use it. He was even teaching me on some things [sic]. I was like, ok, I know the Internet look like, but, he was like, well, you do this [sic]. I am like, ok, [sic] how do I drag this picture over here; I am like we will have to get you some paper to write this. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

He also interacted a good deal with his nephew and even obtained software from him in order to download and create music. Dacey's mom said Dacey was very computer literate and always had a strong interest in computers. She further indicated that he continued to use computers at every possible opportunity and was very comfortable in connecting them to other computer devices and iPods. She also stated that she continued to have a high degree of confidence in his computer abilities and mentioned that the program computer was in Dacey's room.

Summary of CSE Impact

In summary, the data analysis indicated that it was difficult for the researcher to clearly ascertain the impact of Dacey's marginal increase in CSE beliefs after the program on his home computer use and on his family. Dacey continued to use computers at every possible opportunity outside of school and also to help his mom whenever she needed computer assistance.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The data indicated the CompNow program computer was perceived to be useful by Dacey and his family. However, it was not working at the time of the interview due to memory issues, and Dacey was using only the computer monitor by connecting it to his mom's laptop. Dacey's mom also noted that the computer received by her older son two years earlier during a previous edition of the program had now stopped working as well.

Dacey's mom mentioned that she was using the non-program computer to look for jobs, research schools, and medicine. She wanted to go to college as she believed in education and used the computer for figuring out the costs of going to school. She described Dacey's usage of the computer as follows:

> He put music on it, from iTunes, downloads music from his iPod, his brother's iPod, so many gadgets going on, then he turns around. His brother had, well he hooked the laptop to his monitor [sic] and then got the pictures. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

Dacey's mom also mentioned that Dacey used the non-program computer to apply for a scholarship and was proud that he took the initiative to accomplish this task on his own:

> I was doing his scholarship on the computer, he was like, I already did it and I was like, [sic] why don't you tell me this so that I can read it and he was like I took care of it. I was like, ok sweetheart, you are going to get it, don't worry. You will get there, keep doing what you are doing and it will add up. (Interview, 6/5/2010, Public Library adjacent to Dacey's residence).

Additionally, Dacey used computers for playing games, music, and visiting Face Book, and also connected his mom's laptop to other home devices including the iPod. When the CompNow program computer stopped working, he connected the monitor received from the program to his mother's laptop.

In summary, the data indicated that the computer hardware provided by the CompNow program was of limited use to Dacey and his family. When the program computer stopped working, Dacey used the functional monitor which was part of the program computer to connect it to his mother's laptop and thus used it in a productive manner.

Software Programs and Skills

Software skills learned by Dacey during the CompNow program sessions as well as the software provided by the CompNow program had little impact on Dacey and his family because he primarily played games and music on his computer, while the CompNow program focused on imparting software skills related to MS Office Suite. Also, the program did not provide an opportunity for Dacey to learn and enhance skills

relating to multimedia-software. However, the program did provide an opportunity for Dacey to learn Internet search skills and netiquette – beneficial skills in his frequent use of the Face Book website.

Internet Connectivity

The slower dial-up Internet service provided by the program was not used by the family as they already had high-speed home Internet service and did not have an actively working telephone line. A mobile phone service provider was delivering both services to Dacey's family at the time of the interview.

Summary of the Computer's Impact

In summary, the data analysis suggested buying a personal computer would have been difficult for the family because they had limited resources and Dacey's mom did not have a regular job. The fact that Dacey and his brother had participated in the program indicated a strong interest in computers in the family. However, both of their program computers stopped working just a few months after completing the CompNow program. Results of the data analysis indicated that the consistent lack of quality in the CompNow program's computers, lack of use of the dial-up Internet service, and lack of useful software for the family were factors which diminished the impact of the CompNow program computer and Internet connectivity on Dacey and his family.

CASE SEVEN: DANNY

Background

Danny, a Vietnamese male, was an 8th-grade student living with his dad, step-mom, and cousin when he attended the program. He was born in the Midwest in 1996, moved to TexTown with the family shortly thereafter, and attended a TexTown-based

elementary and middle school. His mom and dad were divorced, and Danny had little contact with his mom who was currently living in Hawaii. Danny wanted to become a computer expert in the future.

Danny's family predominantly spoke Vietnamese at home but was also comfortable conversing in English. Danny's dad owned and operated a Vietnamese restaurant in TexTown, while his step-mom helped run its kitchen. Danny did not know his birth-mom's occupation in Hawaii. Danny's dad had previously worked for the U.S. Navy as a computer contractor in a position involving extensive use of computer databases. Now working primarily at the restaurant, Danny's dad was not using the computer very much. His step-mom was not much of a computer user, while Danny's cousin (the same age as Danny) was an occasional computer user. At the beginning of the CompNow program, Danny's family had a home desktop computer that was shared by all family members. They also had high-speed Internet service at their home prior to the program. Prior to participating in the CompNow program, Danny used the computer extensively for gaming purposes. His Dad wanted him to learn how to create games on the computer instead of merely playing games on it.

Danny heard about the CompNow program in school and decided to join the program because he was "bored at school" and thought it would be interesting to participate in the program. Danny's dad wanted his son to learn about computers and felt he should know how to create computer games in addition to simply playing them. Danny's dad wanted him to begin learning about computers and thus encouraged him to join the CompNow program as illustrated in his quote below:

> Because, I tell him [sic]. He was using it [pre-program computer at home] for gaming all the time, and I know computers are for more than games. You should know how to write the game, not just for entertainment. That's why I asked him to learn more. Right now, it is used for wrong purpose [sic]. (Interview, 11/15/2009, Restaurant owned by Danny's family).

Although the program had a major computer company's brand name associated with it, the brand name was not a factor in Danny's program participation. Danny's dad was primarily interested in enabling Danny to learn more about computers, while Danny thought the program would be an interesting experience.

Program Perceptions

Danny perceived the program positively and felt he gained knowledge of computer hardware. He thought the classes were good in general and helped him learn about computer hardware. He also felt the classes were fun and especially enjoyed taking apart the computer and putting it back together. When asked for his perceptions of the program workbook, Danny said he had not used it much since the program's completion.

Danny's dad also liked the program but felt it should have allowed participants to use the software applications a bit more and that additional software such as MS Access should be taught as well. He felt that the CompNow program was a very good first step for his son to learn about computers and also mentioned the need for continuing his son's computer-learning process as illustrated in his quote below:

> I am in the computer field, so, I can help him if he is interested. The problem is in helping him take the first step. I see the advantage of using the program, but the thing it has to be continued. Because right now, he had the program and that's it. He doesn't have any more programs any more, so eventually, they (skills) will just die. I would like to see more programs. (Interview, 11/15/2009, Restaurant owned by Danny's family).

Danny's dad suggested that additional programs be provided for his son to continue learning about computers.

Impact of Program on Computer Self-Efficacy

The data analysis suggested that there were some pre-program factors which affected Danny's pre-program CSE score (130 out of 180 points, program mean: 136.08), and that there were certain program factors which affected Danny's CSE score (132 out of 180 points, program mean: 143.5) at the end of the program. These factors are discussed in the sections below and are followed by a discussion of the program's impact on the participant's CSE beliefs.

Pre-Program Factors Affecting Participant's CSE

Danny had a home computer prior to the program which he used primarily for playing games. This was a sore point with his dad, who had previously worked as a computer programmer in the U. S. military but was operating a restaurant at the time of Danny's program participation. His dad felt Danny was not making the best use of the computer and wanted him to learn how to create games as well as merely playing them. Additionally, Danny came into the program with a lukewarm interest in learning more about computers. The data analysis indicated that Danny's limited use of the computer, his dad's strong perception about Danny's lack of computer knowledge, and Danny's limited interest in learning more about computers likely had a significant bearing on his below-average score in the CSE questionnaire.

Program Factors Affecting Participant's CSE

The researcher observed that Danny seemed only moderately engaged during the instructor's demonstrations on the computer during the CompNow program sessions. However, he was able to successfully complete the test relating to the disassembly and

reassembly of the computer hardware and was also able to install successfully Windows Operating System. Furthermore, he was generally quiet in class and showed very limited interest in learning software skills during the program, but he diligently worked on the Internet search-related exercises. Danny was, therefore, able to experience a limited amount of modeling of computer activities by the instructor, had successful hands-on experiences with computer hardware, and limited hands-on experiences with software and the Internet.

Danny's dad paid very close attention to Danny's activities during the program and felt he was only able to take the first step toward learning about computers. Danny obtained limited and discouraging feedback from his dad regarding his progress in the program.

The data analysis indicated that the lack of change in Danny's CSE beliefs could, therefore, be attributed to the factors discussed in this section. Additional details about Danny's experiences during the program are presented below.

Modeling and Hands-on Experiences

During the program, Danny was generally quiet in class and showed greater interest in learning about computer hardware and the Internet than computer software. He diligently worked on understanding the hardware components and completed computer hardware literacy-related exercises which included multiple-choice and fill-in-the-blank questions, in addition to drawing the front and back of the computer. Danny completed only a couple of software exercises relating to MS Excel and the managing of files and folders. Danny demonstrated his knowledge of the Internet by completing all the program exercises involving use of the Google search engine to visit websites and find facts and images on the Internet.

Family Support during Program

During the program, Danny showed his notes to his dad and discussed what he had learned in class. His dad regularly reviewed his progress in the program and also spent time with him discussing what he was learning in the program. Danny's dad paid very close attention to Danny's activities during the program and felt the program had a limited but positive impact on his son's knowledge about computers as demonstrated in his quote below:

> I would ask him questions like, what is a processor, what is memory, things like that and he first did not know [sic] and he answered them eventually. He would ask about cost of some things, so he got some knowledge [sic]. He would ask about software, so he got some knowledge. (Interview, 11/15/2009, Restaurant owned by Danny's family).

However, Danny's dad felt Danny was only able to take the first step toward learning about computers. The data suggested that Danny did not receive positive feedback about his activities during the program, as his dad continued to feel his son spent excessive time playing games on the computer.

Danny's attendance records indicated he missed only one program session and subsequently attended a make-up session held before school started the next day.

Computer and Internet Literacy

The CompNow program provided affordances for Danny to become more computer and Internet literate by discussing computer and Internet terminology during program sessions among peers and with the program instructor. The program also provided opportunities to complete exercises and tasks relating to computer and Internet literacy, a key 21st-century skill. During the CompNow program sessions, he

demonstrated his knowledge about computer hardware and the Internet by completing the program exercises in the workbook. However, he demonstrated little literacy with regard to computer software during the program – he partially completed a software exercise on MS Excel and MS Word and did not attempt the remaining exercises on MS Paint and MS Power Point. He also did not mention any terms relating to computer hardware, software, nor the Internet while discussing his comfort level with computers and in describing his at-home computer activities with the researcher.

Program's Impact on CSE Beliefs

Danny scored 130 (maximum score: 180) in the Computer Self-Efficacy Questionnaire which was administered before the program – this was lower than the mean score of 136.08 for the class. At the end of the program, Danny scored 132 in the Computer Self-Efficacy questionnaire which was lower than the class mean score of 143.5. His score increased by 2 points after the program which converted to a very low 1.54% increase in his score as a result of the program.

The data indicated that Danny's CSE beliefs were not impacted much by the program and suggested that his limited engagement in class activities, coupled with his dad's consistently disparaging feedback about his computer activities, contributed to his CSE beliefs' remaining below the program average.

Impact of Change in Computer Self-Efficacy on Home Computer Use and Family

Impact on Home Computer Use

Danny felt his confidence in computers had increased slightly after the program. When asked if it were important to work with computers in his everyday life, he replied by saying that computers were useful for playing games. With regard to his future,

Danny felt he would be working with computers. He expressed a desire to work with computers in the future and wanted to be a computer expert. The minimal increase in Danny's CSE beliefs was reflected in the fact that there was no change in how Danny used computers at home. He was using computers as extensively as he did before the program and continued to use the computer at home for playing games and movies.

Impact on Family

Danny collaborated with his dad in attempting to install a video card on the program computer. He interacted with other program participants to work on collaborative exercises in class but did not work on computers with his friends after the program was completed. He had not been in touch with any other participants since his completion of the program. He felt his cousin did not know much about computers and indicated he helped her with computer activities as needed.

Danny's dad clearly felt his son was using the computer mostly for gaming purposes and felt Danny should learn more and become capable of creating his own games as illustrated by his statement below:

> If you work hard and apply, you can create your own game [sic]. No doubt about that. In order to do that, you have to invest your time. You have to learn more, because without that, you are going to just play. (Interview, 11/15/2009, Restaurant owned by Danny's family).

Several months after CompNow program's completion, Danny's dad continued to express the need for Danny to continue learning about computers and did not seem very confident about Danny's computer abilities. When Danny mentioned he knew some of the software used in the program, his dad contradicted him by saying that Danny was probably only aware of those programs and had not used them in any meaningful way. He felt Danny should work hard to learn more about computers, including databases, and

learn how to write his own games. He felt his own strong computer background would enable him to help Danny if he were interested in learning more about computers. He also believed Danny would use the computer more if he learned more about it and said that reinforcement of Danny's learning experiences in the program was essential. However, the CompNow program computer was in Danny's room, thus indicating some confidence in his abilities to make proper use of it.

Summary of CSE Impact

In summary, the data analysis indicated there was a slight increase in Danny's CSE beliefs after the program, and his activities on the computer did not change after the program. His computer-literate dad, who was critical of his extensive use of the home computer for games prior to the program, saw only a slight increase in Danny's confidence and knowledge about computers after completing the CompNow program.

Impact of Computer and Internet Connectivity on Participant and Family

Computer Hardware

The computer hardware received through the CompNow program did not have an impact on the family as it was considered too old for installing the necessary upgrades to make it usable. Danny and his family were unable to find a use for the computer and were planning to give it away. Danny had attempted to install a video card on the program computer with his dad's help, but hardware issues prevented him from doing so. Danny and his dad mentioned that the pre-program computer was still the only working computer in their home, and that Danny was primarily using it for games and for trying out free programs available on the Internet for making and editing movies. Danny said that he was on the computer "all day" both before and after the program but used the computers available at his school for completing his schoolwork.

Software Programs and Skills

The researcher noted earlier Danny did not demonstrate much interest in learning the software skills related to MS Office Suite during the program and did not provide adequate evidence of his skills in completing the program exercises relating to software. Additionally, Danny spent almost all his time on the computer at home for playing games, and the program did not provide any opportunity to learn and enhance those skills. As mentioned earlier, Danny had attempted to install a couple of programs from the CD provided by the program but could not do so due to computer hardware limitations. The data analysis, therefore, suggested the software skills imparted by the program as well as the software provided by the program had minimal, if any, impact on Danny and his family.

Internet Connectivity

The slower dial-up Internet service provided by the program was not used by the family, as they already had high-speed Internet service in their home. Moreover, the limited functionality of the program computer dissuaded them from connecting it to the Internet.

Summary of the Computer's Impact

In summary, the data analysis indicated that the presence of another computer in the home coupled with the hardware limitations of the program computer greatly diminished the impact of the program computer on Danny and his family. The presence of high-speed Internet service in their home significantly reduced the chances of Danny and his family utilizing the slower dial-up Internet service.

TARGET AND NON-TARGET POPULATIONS COMPARISON

The CompNow program was perceived positively by participants and their parents from both Target and Non-target Populations. While participants enjoyed the hands-on components of the program, parents generally felt the CompNow program helped their children learn about computers and become more skilled and confident with them. Both populations expressed a strong interest in additional programs that could help the participants continue their computer learning process.

The Target Population felt the program met its objective of providing a computer to students from underserved families. They also expressed a desire to participate in a similar program which could help parents learn about computers. The Target Population expressed greater appreciation for the program computer than the Non-target Population. More members of the Target Population used the software skills learned during the program than the Non-target Population.

No member of either population utilized the free dial-up Internet service made available to them for one year by the program. However, the reasons for doing so were different for the two populations. While the Non-target Population already had high-speed Internet in their homes, the Target Population could not afford the landline necessary to take advantage of the Internet service. In one instance, a family from the Target Population reported they could not obtain any technical support to help them utilize the service.

Two parents from the Non-target Population felt the CompNow program's curriculum was neither broad nor rigorous enough for students to become truly skilled in computers. These parents suggested that the program duration be extended and/or additional programs which provide training on advanced computer topics be made available.

RESULTS SUMMARY

The three research questions outlined for the study were answered as follows.

1. *How did participation in the program affect students' self-efficacy beliefs in their computer skills?*

The results of the statistical analysis of CSE scores indicated that while a majority of participants experienced an increase in their CSE, the program did not have a statistically significant change in participants' CSE. However, a majority of the participants (9 out of 12) increased their CSE beliefs during the program.

2. *How did change in computer self-efficacy beliefs in participants impact their usage of computer and Internet connectivity at their homes?*

Participants whose CSE beliefs increased during the program expressed increased confidence in computers after completing the CompNow program, and their families appreciated their child's noticeable increase in both computer skills and interest. These participants generally spent increased time on computers at home after the CompNow program. Most participants were also able to provide increased computer assistance to family members after completing the CompNow program. Additionally, participants achieved increased levels of computer and Internet literacy, a 21st-century skill. The researcher could not conduct interviews with the three participants in the program whose CSE beliefs decreased during the program. One participant whose CSE scores stayed below the program mean and increased only marginally (1.54%) at the end of the program demonstrated no change in his computer usage after the program.

Participants with higher CSE beliefs attempted computer activities not conducted during the program. For example, some participants attempted to add video cards and graphics cards to their program computers. Other participants attempted to add memory, while some attempted to connect their program computer to high-speed Internet service

in their home and to other devices such as digital cameras and iPods. Mixed results occurred with these computer activities due to variations in computer quality as well as in participants' computer skills.

3. *How did the introduction of a computer and Internet connectivity into the learners' homes impact the learners and their families?*

Families who had no computer prior to the program appreciated the program computer more than families who already had a computer in their homes. Almost all the participants and parents interviewed by the researcher stated they were disappointed by the quality of the program computer as it was outdated, short on memory, and/or had problems with upgrades. The program provided opportunities to learn software skills relating to preparing documents, spread sheets, and presentations. These skills were not used much by most of the participants after completing the program since they used the program computer mostly for playing games, music, and/or videos in addition to uploading photos and accessing the Internet. Opportunities for participants to enhance their skills on computer games along with software for music and video editing were not provided during the program.

The dial-up Internet service offered cost-free for one year by the CompNow program was not utilized by any of the participants and their families interviewed by the researcher. They either already had high-speed Internet service in their home or did not have the necessary telephone line to take advantage of the free service. Families who truly could not afford a phone line could not experience the benefits of Internet connectivity, either due to technical issues and/or because they could not afford a working phone line.

Chapter 5: Discussion

This chapter begins with a summary of the study and the results that lead into a discussion of key factors affecting the program's impact in the areas of digital equity and participants' CSE beliefs. Implications of these findings and future research ideas are presented at the end of the discussion of each key factor. The final section of this chapter draws conclusions from the study.

The CompNow program is the product of (a) a partnership between a for-profit computer manufacturer whose aim was to provide desktop computers and basic computer skills for middle school students from underserved populations, (b) school districts that were interested in addressing digital equity issues within their middle schools, and (c) non-profit organizations interested in delivering these programs to middle schools. Due to the program's focus on digital equity, the researcher selected it to investigate its impact on participants and their families.

The study focused on understanding the impact of the program on the computer self-efficacy (CSE) beliefs of participants, how their CSE beliefs impacted their use of the computer and Internet connectivity at home, and finally, how the introduction of the computer and Internet connectivity impacted both participants and their families. The researcher conducted a statistical analysis of the scores obtained regarding participants' CSE beliefs through a questionnaire administered before and after the program. This analysis was followed up with a qualitative analysis on the impact of the computer, Internet connectivity, and the program itself with participants and their parents approximately six months after program completion.

This study investigated the impact of the program from two lenses: computer self-efficacy and digital equity. Results of the study showed that while changes in CSE

beliefs as a result of the program were not significant overall, a majority of participants (9 out of 12) increased their CSE beliefs during the program. The results also showed that the program helped provide increased computer access to participants and parents, slightly increased CSE beliefs of most participants, and helped participants acquire or enhance their Internet and computer literacy -- which is considered a critical 21st-century skill. The following discussion examines key factors suggested by the study as affecting the program's impact in the areas of digital equity and participants' CSE beliefs.

QUALITY OF COMPUTER HARDWARE AND INTERNET SERVICE

Discussion

In exploring factors which promote the digital divide among the haves and have-nots, Resta and McLaughlin (2003) identified access to technology, among other factors, as playing a key role in promoting digital equity; while Solomon (2002) highlighted the quality of hardware and connections as a major barrier to digital equity. This study found that the CompNow program delivered increased access to computers but provided computers of inconsistent quality and provisioned dial-up Internet connectivity that was not useful to participants. The researcher observed during the program that computers of varying configurations (screen size; size of random access memory; size of storage space; and quality of keyboards, mice, and outer covers) were provided to participants. The researcher also observed that some computers were dirty and dysfunctional when they arrived at CTMS. The program instructor spent a weekend cleaning some of the computers and fixing some technical issues with them at the beginning of the program. Due to the varying quality and configurations of the program computers, the instructor had to resort to a random assignment of computers to participants to ensure that those participants who received computers of relatively inferior configuration/quality did not

feel discriminated against those participants who received computers with larger memory, better speakers or newer monitors. During the program, the researcher provided occasional assistance to the program instructor and observed that many of the computers were more than 5 years old. It was outside the scope of this study to undertake a review of the quality-assurance process undertaken by program organizers. The varying quality of program computers might have played a role in the differing perceptions of the computer's usefulness among participants and parents.

Solomon (2002) suggested low-income groups use computers for lower-order skills more often than higher-income groups. In this study, the researcher found participants such as Kaycee and Madison, who came from economically-disadvantaged families and received their first home computer through the CompNow program, did perceive the computer to be useful and used it in ways that were somewhat limited to their experiences in the CompNow program. They also appreciated the increased access to computers at home. On the other hand, participants such as Carey and Danny, who already had a home computer prior to the program, and whose parents had regular incomes, tried to connect their program computer to a high-speed Internet service rather than the dial-up service offered by the CompNow program). They attempted to install new software not provided by the CompNow program. However, Carey and Danny were disappointed to discover their computers' outdated hardware prevented them from successfully completing these tasks. Their computer-literate dads tried to help them upgrade their program computers but could not do so due to hardware problems and the upgrade expenses involved. Others such as Josh and Rizzo, whose families could not afford to buy them a computer of their own, were happy to have a computer for personal use yet noted the outdated nature of their program computers and their susceptibility to failure.

The researcher felt that participants might have gone home from the CompNow program with false expectations about the computer received from the program. False expectations might have resulted from the fact that the hardware-related program exercises and the installation of Windows operating system were successfully completed by participants on the computers they were taking home, but the software- and Internet-related exercises were conducted on newer and more powerful computers (in comparison to the program computers) at the school's computer lab. Consequently, participants did not have an opportunity to truly understand the performance limitations of the program computers. Therefore, they may have developed false expectations about the capabilities of the program computer which caused some participants to perceive those computers as being slow and dysfunctional in their homes.

Additionally, the researcher noted that information about the working condition of the program computers, their limitations, and their maintenance requirements were not provided to CompNow program participants. The inclusion of this information in the program workbook could have greatly helped participants and their parents to understand more fully the limitations and maintenance needs of their program computer. This information would not only have helped set the correct expectations about the computer's condition. It could have eventually helped enhance the perceived usefulness of the computer among participants and their families.

Data released by the U.S. Commerce Department indicates that Americans in lower-income and rural communities have slower Internet connections than the rest of the country's population (Kang, 2011). Participants in the CompNow program and their families did not find the free dial-up Internet connection offered by the program to be useful in their homes, since it was the slowest form of Internet service and required the presence of a working and active home phone line. Recent data suggests that many

families are opting to use high-speed Internet service and cell phones in lieu of landlines. Smith (2010) showed that 66% of the U.S. population had a broadband connection at home in 2010, compared to 15% in 2003. Blumberg and Luke (2010) found that 24.5% of the U.S. population had only wireless telephones and no landlines in their home in 2010, compared to 5% in 2003. The CompNow program seemed to have failed in its efforts to increase Internet access to students and their families from underserved populations. Participants from the program's target population such as Kaycee, Madison, and Rizzo did not have active phone lines in their homes and relied solely on cell phones for their communication needs. They could neither afford high-speed Internet service nor take advantage of the dial-up Internet service provided by the CompNow program. Kaycee's mom lamented that she could not afford a phone line in order to take advantage of the free dial-up Internet service. On the other hand, participants from non-target population such as Corey, Danny, and Dacey, who already had high-speed Internet in their homes, did not see the value of transferring to a slower dial-up Internet service offered by CompNow program.

The study suggests that the lack of technical support for participants after they completed the CompNow program played a role in some participants' being unable to use their computers effectively for Internet connectivity. Corey and Danny could not connect the program computer to the high-speed Internet connection in their homes, despite assistance from their computer-literate dads. Madison and her aunt needed technical help to use the dial-up Internet service but did not know whom to contact nor how. The information provided in the CompNow program workbook was not sufficient to help the participants and their families resolve their connectivity issues.

The study also suggests a pattern between post-program CSE scores and computer quality perceptions. Participants with higher post-program CSE scores felt more strongly

that the computer was outdated and failing than participants with average post-program CSE scores. Corey and Josh scored some of the highest pre-program and post-program CSE scores among participants interviewed for the study. Both perceived the computer to be of poor quality, requiring costly upgrades and additional memory. Another participant, Rizzo, who scored lower than the pre-program mean score but had an increase of 30% in his post-program CSE score to obtain the highest post-program score among all participants, also perceived the computer to be slow and outdated. On the other hand, Kaycee and Madison, who scored just a little over the post-program mean value, found the computer to be useful and did not perceive it to be slow or outdated. Further research is necessary to determine the reasons for the existence of this pattern.

The Pew Research Center found the digital world has moved beyond the desktop (Smith, 2010). The Center found that 52% of Americans own a laptop and 75% of U.S. teens own a cell phone. Another study conducted by The Pew Research Center found that 27% of teens with cell phones use their cell phone for Internet access, and 21% of teen cell-phone users go online only with their cell phone (Lenhart et al., 2010). It also found that 44% of black teens and 35% of Hispanic teens use their cell phones to go online, compared with 25% of white teens. The researcher's study suggests that the CompNow program must consider providing mobile devices and high-speed wireless Internet connectivity in place of desktop computers and dial-up Internet service.

The CompNow program appears to have fallen short of its digital equity goal of increasing home computer ownership and internet connectivity among underserved populations because the program provided slow dial-up Internet service as well as outdated computers whose hardware and software configurations were generally not useful to its participants. Families from the program's target population received an outdated desktop computer with no Internet connectivity; families who desired an

additional computer for their children's personal use found the computers to be of little applicability, since they either could not be connected to the Internet or were slow and dysfunctional. The researcher can only speculate that these issues were due to the fact that CompNow program organizers had to make do with donated, outdated desktop computers and that the cost of providing high-speed Internet connectivity was prohibitive for the program's organizers. Therefore, the study suggests that the program enabled increased access to computers, but with limitations on computer use and Internet connectivity.

Six months after the program, the study found computer ownership to be of some benefit to program participants and their families. However, the outdated computers and dial-up Internet service provided by the program are not enabling the young students to fully experience the participatory culture of the Internet. Jenkins et al. (2006) explained that the Internet fosters a participatory culture enabling youths to (a) form affiliations with others via online communities, (b) express themselves in the digital world, (c) work online with others and complete tasks, and (d) experience informal mentorship whereby more experienced members of online communities pass along their knowledge to novices. For these programs to have a greater impact on their participants, a greater understanding of youths' current uses of technology, student needs, resource constraints, school districts' digital equity objectives, and community involvement are required by its stakeholders to identify factors that make these programs sustainable and meaningful.

Implications

Efforts to bridge the digital divide are undermined by programs which provide dial-up Internet service and old, outdated computers of poor quality to students from underserved populations. Providing good-quality computers with reasonably adequate

memory, processing power and high-speed Internet connectivity is essential for equitable access to computers and the Internet by underserved populations. Streicher-Porte et al. (2009) analyzed a program undertaken by the government of Colombia to provide refurbished computers of high quality to its schools. They found that locally refurbished computers of good quality with a lifespan of at least 5 years could be provided to Colombian schools in a sustainable manner. At a time when the digital world is moving beyond the desktop to mobile devices and high-speed internet connectivity, programs such as CompNow, although well intentioned, seem to be failing to address the digital needs of the underserved. They appear to be in need of reinventing themselves to foster effective participation of underserved populations in online communities by using digital media devices including laptops, smart phones, and televisions.

Some steps that could be undertaken at the CompNow program being conducted at the school included in this study are as follows:

1. The greater TexTown area is home to a number of high-tech companies; CTPIE and CTISD can work together to work with them and develop programs that enable these companies to donate their used computers of good quality to the program on a regular basis.
2. Computers and Internet service must have the following characteristics:
    a. 3-year old (or newer) computers
    b. High-speed Internet, preferably wireless
    c. Latest operating system (Windows 7 or equivalent)
    d. Sufficient random access memory (2 GB or higher) to enable adequate performance with the latest operating system
    e. Processor powerful enough to run latest operating system (1 Gigahertz or higher)

f. Graphics driver installed in computer that is compatible with the latest operating system installed on the computer
g. Monitors, speakers, keyboards and mice with every computer
h. 150GB or higher hard disk for data storage
i. Clean and in working condition

3. Documentation must be provided to participants that contain configuration details and maintenance tips specific to the computer being provided for the program participant.
4. Cost-effective ways of providing a printer and 1-year supply of printer ink must be considered.

Future Research

More research is needed to develop an understanding of the factors which led the CompNow program to select outdated computer hardware, software, and Internet service. This understanding is essential to help realize the promise of digital equity from programs such as CompNow. Warschauer (2010) posited that the type of digital divide pertaining to the inequitable access to computers and the Internet for U.S. youth has been largely resolved because these young people are able to find access either in their own homes or at a public location such as their school or a nearby public library. However, he found that a new type of digital divide exists wherein the ability to use new digital media for communication, analysis of information, and working with others is not distributed among youth in an equitable manner. Research is needed to understand how programs such as CompNow can be transformed to address this new digital divide. Research is also needed to understand how programs such as CompNow can adapt and provide equitable access, training, and support to enable students from underserved populations to

access, use, and understand mobile devices such as laptops and smart phones. Additionally, future research is needed to understand how equitable access to digital media can impact the social and economic needs and futures of underserved populations.

Further research is also necessary to find ways in which for-profit and non-profit organizations can work with municipal and/or county governments in providing sustainable and affordable internet connectivity. Municipal governments in cities including Chicago, Palo Alto, Seattle, and Austin contemplated building city-supported networks but obtained mixed results (Horrigan & Rainie, 2007), while cities such as Philadelphia and New York are planning to provide high-speed wireless Internet access using Wi-Fi technologies that allow true broadband speeds of up to ten Megabits per second (Carpenter, 2010). Additional research is also needed to develop models for sustainable partnerships between organizations drawn from private, public, and non-profit sectors to meet the changing digital needs of underserved populations.

SOFTWARE AND LEARNING CONTENT

Discussion

Pittman et al. (2004) explained that the development of 21st-century skills includes multimedia communication skills as well as media literacy. To bridge the digital divide, Jenkins et al. (2006) advocated the development of participatory skills, including cultural competencies and social skills, as necessary for full involvement in the digital media world. The Kaiser Foundation published a report which considered televisions, computers, Internet, music, and video to be key components of recreational digital media in addition to finding that young people significantly increase their use of those media when they hit the 11- to 14-year-old age group (Rideout et al., 2010). The same report also found that Hispanic and Black youths are exposed to digital media approximately 13

hours daily, compared to just over 8½ hours among Whites. The CompNow program did not provide opportunities for participants to use and experience multimedia software. It also failed to provide opportunities for participants to express themselves culturally using multimedia applications and to develop skills to socially engage with other participants in the online world. Instead, the CompNow program's curriculum focused on developing computer skills relating to computer disassembly and assembly, MS Office software, and Internet searches. These skills are of limited use to middle school students. The program also provided a CD to its participants upon completion containing software similar to the applications learned during the program – these software are generally unused by middle school students in their homes.

Limited Opportunities for Online Participation

Jenkins et al. (2006) suggested that challenges for bridging the digital divide include a "participation gap" and a "transparency problem." "Participation Gap" refers to the unequal access to full participation in the digital world, while "Transparency Problem" refers to the challenges faced by young learners to see clearly the ways in which the media shape their world perceptions. Solomon (2002) posited that students become empowered as learners and thinkers when they create and share reports, Web pages, or digital presentations requiring higher-order skills. The study suggests that the program software learning objectives were not focused on developing higher-order skills among participants. The study also suggests that the program perpetuated the transparency problem by not providing opportunities for participants to develop their understanding of the use of digital media nor how media shapes their world perceptions. The program seemed to have been strongly influenced by the dominant business culture geared toward the use of productivity tools relating to documentation, analysis, and

presentations. Analysis of the data revealed that participants undertook software exercises during the CompNow program sessions which afforded them an opportunity to learn the basic operational elements of MS Office software including MS Office, MS Excel, and MS Power Point. These exercises enabled them to undertake tasks related to the writing of a paragraph about their life, the preparation of a graph from two columns of technical data provided on a spreadsheet, and, finally, the preparation of a presentation about their life. Additionally, participants conducted Internet searches to answer trivia-type questions through searching for information and images on the web. This task provided opportunities to learn about search engines while simultaneously enabling the instructor to discuss ways and means for surfing the Internet safely. However, participants did not have an opportunity to gain the knowledge necessary for online participation including photo repositories and creative commons. Although the participants spent half their time in the program learning software skills, they made little use of those skills after completing the program because they did not find these skills relevant to their activities outside school. While these exercises could prove useful for future student schoolwork and assignments, the researcher felt these exercises represented a missed opportunity for enabling participants to develop media literacy and skills such as web-page design, creation of multimedia content, and preparation of digital presentations requiring higher-order skills.

The study found the majority of participants interviewed by the researcher used the computer they received for play rather than schoolwork. Their computer activities included playing music and videos, downloading and editing images, and playing games. The parents of program participants also used home computers primarily for recreational rather than for work or educational purposes. Jenkins et al. (2006) identified play as one of a set of new social skills considered necessary for young people's participation in the

digital world and described it as the capacity to experiment with one's surroundings as a form of problem-solving. The CompNow program did not include play as a form of problem-solving in its curriculum. Consequently, the program missed an opportunity to guide its participants toward developing their problem-solving skills using play in the digital world.

Lack of Culturally-Responsive Content

Resta and McLaughlin (2003) posited that the provisioning of high-quality, culturally-responsive learning content is a critical factor in bridging the digital divide. Culturally-responsive curriculum uses the cultural characteristics, experiences, and perspectives of ethnically diverse students as part of its learning content (Gay, 2002). The CompNow program did not offer culturally-responsive learning content as part of the curriculum, even though its participants were drawn from varying socio-economic backgrounds and included Hispanics, African-Americans, and Caucasians, as well as both genders. Gay (2002) highlighted the significance of using symbolic curriculum and societal curriculum as ways of providing cultural significance within the learning content. Gay explained that symbolic curriculum refers to images, symbols, icons, mottoes, awards, celebrations, and other artifacts that are used to teach students knowledge, skills, morals, and values – they convey important information, values, and actions about ethnic and cultural diversity. Societal curriculum refers to affordances incorporated in the curriculum for critical analysis about knowledge, ideas, and impressions about ethnic groups that are portrayed in the mass media. By not including symbolic and societal curricula in the learning content, the program missed an opportunity to enable participants to experience technical learning in a socio-cultural context which may have resulted in an increased impact on their computer self-efficacy, as well as to promote the

use of computers for learning about their individual cultures. The software exercises and Internet search exercises included in the program could be enhanced to provide culturally-responsive learning opportunities for participants and strengthen the program's efforts to provide equitable access to technology for middle school students from underserved communities.

In summary, the study suggests that the software provided to participants enabled access to critical software needed for future schoolwork and employment for program participants and their families from underserved populations. However, participants and their families did not use the software very much at home but instead used the computer for browsing the Internet and recreational purposes. The program's curriculum also focused on developing basic skills in using the computer hardware and software but did not provide any opportunities for participants to experience the participatory culture of the Internet and simultaneously increase their digital media literacy. Finally, the program's learning materials did not contain culturally-sensitive content which could have helped the program's diverse participants develop a sense of what it means to successfully complete the computer tasks being conducted during the program.

Implications

Training and access to multimedia software can enable program participants to experience and create multimedia content. Additional software and learning content that provide affordances for program participants to develop literacy in new digital media and experience the participatory culture of the Internet are needed. Opportunities for problem-solving activities using play-based computer tasks need to be included in the curriculum of programs such as CompNow. Culturally-responsive learning content that is appropriate for underserved middle school students drawn from Hispanic, African-

American, and Caucasian populations can be incorporated into existing software exercises in the CompNow curriculum. The task of incorporating both symbolic and societal curriculum into a ten-week after-school program providing computer skills training requires an awareness of (a) the expected composition of future program participants, (b) the expected learning outcomes, and (c) culturally responsive instructors. Changes in population demographics as well as the rapid rate of changes in technology are additional challenges to be considered.

Some steps that could be undertaken at the CompNow program being conducted at the school included in this study are as follows:

1. Revise some of the Internet search activities included in the program to incorporate culturally-responsive content. Tasks to search for images, personalities, and historical facts relevant to the participants' demographics (Hispanic, African-American, Asian and Caucasian in this case) could replace some of the search exercises in the program workbook. Opportunities could be provided for participants to analyze the results and understand how it relates to their lives outside the classroom.
2. Provide opportunities for students' participation in online communities using social networking tools such as Facebook, MySpace and Twitter.
3. Provide software and learning opportunities for participants to create multimedia content, understand content copyright issues and share their creations with others.

Future Research

Additional research is needed to understand what it means to be computer literate in the light of the digital world moving beyond the desktop to mobile devices and

participatory online communities. Further research is needed to develop new instructional models developing media literacy among middle-school students from underserved populations and enable them to experience the participatory culture of the Internet. Researchers also need to find ways in which culturally-responsive curricula could be developed to foster sustainable digital equity programs for middle school children.

PARTICIPANT MIX IN THE PROGRAM

Discussion

Participants for the CompNow program were expected to be drawn from its target population. The Target Population was expected to have an interest in learning computer skills and come from economically disadvantaged families who did not have a computer at home. Additionally, the program's selection criteria provided for a higher priority to be given to participants from 7th and 8th grades as well as to participants who were academically under-performing at school. The school gave priority to 8th-grade students over 7th- and 6th- graders but did not always choose program participants from the Target Population. While all participants expressed some interest in learning computer skills, eight out of the thirteen participants seemed to be from the Target Population. The researcher came to this conclusion after reviewing the information provided by participants and their parents on program entry forms which was used to select participants for the program. Amongst the participants interviewed for the study, four participants out of seven (Kaycee, Madison, Rizzo and Josh) seemed to come from economically disadvantaged populations and only three participants (Kaycee, Madison, and Rizzo) came from families who did not have a home computer and high-speed Internet service in their homes. Josh's family had an outdated and desktop computer in

their home that was barely functioning prior to the program. After Josh completed the program, his family obtained high-speed Internet service at their home. Danny and Corey were from families who did not seem to be economically disadvantaged (their families had regular incomes either through employment or business) and had a working computer with high-speed Internet connections in their homes prior to the program. Dacey's mom seemed to be in and out of jobs but the family had a working laptop with high-speed Internet connection in their home prior to the program.

The researcher mentioned earlier those participants who came from families who never had home computers prior to the program perceived the program computer to be more useful and spent more time on it than the other participants. The study, therefore, suggests that the CompNow program might have had a stronger impact on more participants if the selection criteria outlined earlier were used in a more effective manner to select program participants.

Implications

The impact of the program could be enhanced by more rigorous enforcement of participant selection criteria resulting in more participation from middle school students drawn from the program's target population. The potential exists, however, for novices to interact with their more computer-literate peers who have a computer in their home. Engaged learning due to peer-to-peer interaction can occur when advanced learners provide mentorship to less-advanced learners. Research has shown that a cognitive apprenticeship model for learning can foster learning and knowledge transfer between novices and experts when peers work together on authentic tasks in a situated context under the guidance of an expert (Collins et al., 1991). Programs such as CompNow need to determine ways in which novices can learn from their peers who have greater skills

and exposure to computers and the Internet. These programs should also find ways to realize more fully the benefits suggested by the cognitive apprenticeship model for engaged and effective learning. Those ways could include providing opportunities for participants who successfully complete the program to help participants in subsequent editions of the program.

At the CompNow program being conducted at the school included in this study, the researcher concludes that a rigorous review of the participants' profiles must be conducted to determine whether the mix of participants found in this study is a consistent occurrence at the school. If so, the program instructor should consider utilizing participants from non-target populations in a "helper" role to provide computer assistance to remaining participants. This can help foster the transfer of non-target population participants' computer knowledge and experience to participants from target populations.

Future Research

The study found that most of the program participants used computers for activities which were different from the computer activities conducted during the program. More research is needed on the socio-cultural factors affecting the use of computer technology in the home as well finding ways in which after-school programs in computer literacy can support home technology use. Additional research is needed to understand whether digital equity programs can incorporate the attributes of the cognitive apprenticeship model to enhance the participants' learning experiences. By enabling interaction between target population participants (novices) and non-target population participants (experts), affordances for peer-based learning and knowledge transfer between experts and novices can be included. Further research is also needed to understand how at-home computer experiences of program participants can be brought

into the program sessions so that novices can learn from their more-experienced peers – this can also help foster participatory skills among participants which are essential to participate effectively in online communities.

COMPUTER SELF-EFFICACY, COMPUTER USAGE, AND INTEREST

Discussion

Hsu and Huang (2006) found that computer use and interest had a direct and positive impact on computer self-efficacy. This study found that participants from both target and non-target populations entered the CompNow program with varying levels of computer experience and interest which affected their CSE beliefs. As mentioned in previous sections, Josh, Kaycee, Madison and Rizzo seemed to be from the target population while Carey, Danny and Dacey appeared to be from the non-target population based on the researcher's review of their program entry forms. Josh and Carey entered the program with higher levels of computer experience than Kaycee, Rizzo, and Madison. Josh and Carey had higher pre-program CSE than Kaycee, Rizzo, and Madison as well. Danny, who did not express a strong interest in learning about computers and only played games on his home computer prior to the program, obtained pre-program scores below the program mean. However, the study suggests that participants who continued to stay engaged throughout the program completed it with enhanced CSE, regardless of their pre-program CSE. Participants such as Kaycee, Madison, and Rizzo did not have high CSE prior to the program but diligently worked to enhance their CSE by the program's end. Participants such as Corey, Dacey, and Josh had higher pre-program CSE than the remaining participants and further enhanced their CSE after completing the program. However, Danny, who entered the program with low CSE and low interest in computer learning, was engaged only in some of the computer tasks during the program and thus

enhanced his CSE by the least amount among all participants interviewed for the study. Danny, who had a strong interest in computer games and their inclusion in the program's curriculum, could have enhanced his engagement in the program and further increased his computer self-efficacy. Rizzo and Kaycee had the highest increases in their CSE beliefs during the program; Josh and Dacey had the highest CSE scores at the end of the program.

Program participants from both target and non-target populations who had higher levels of pre-program computer experience scored higher pre-program CSE scores than the other participants. Participants from both populations who sustained their interest in computer learning during the program and completed the program exercises and tasks enhanced their CSE beliefs at the end of the program. Rizzo and Kaycee from the target population experienced the biggest increases in CSE beliefs at the end of the program among all participants while Corey from the target population experienced the third biggest increase amongst all participants. Josh from the target population had the highest pre-program CSE among all participants; he and Dacey from the non-target population had the highest CSE beliefs at the end of the program.

The study also found that participants with higher pre- and post-program CSE beliefs attempted to use their program computer at home in different ways than the computer activities conducted during the program. Corey, working with his dad, attempted to install additional memory on the program computer, to connect the program computer to high-speed Internet service, and to install software that was not used during the CompNow program. Josh installed additional memory on the program computer and tried to install to additional software as well. Dacey attempted to install additional memory on the program computer and connected other electronic devices to the monitor obtained through the CompNow program. Participants such as Kaycee, Madison, and

Rizzo had low-to-average pre-program CSE and enhanced their CSE after completing the program. They increased the amount of time spent on computer activities at home but restricted themselves to either using the computer for recreational purposes or for tasks the learned during the program. Danny, who had low CSE at the start of the CompNow program and slightly enhanced his CSE by the end of the program, did not change the nature of his computer usage at home after completing the program. Prior to the program, he was using his computer extensively at home for playing games and continued to do the same activities after completing the program.

Implications

The assessment of program participants' CSE before and after programs such as CompNow can help understand the various ways in which participants might use their program computers at home. Programs such as CompNow need to find additional ways in which computer tasks undertaken during the program can enhance participants' confidence in their computer skills and lead to increased CSE beliefs. These could include the use of computer games for learning and problem-solving.

At the school included in this study, program organizers could include exercises that enhance the CSE of participants in the areas of online participation and multimedia use.

Future Research

A larger study is needed along with a control group to determine more accurately the extent to which programs such as CompNow affect CSE among middle-school students. Additional research is needed to understand the home environment and use of computers and the Internet among middle school students from underserved populations.

Such an understanding can lead to the development of improved computer tasks in the program's curriculum which result in increased CSE beliefs among program participants.

VICARIOUS AND MASTERY EXPERIENCES DURING PROGRAM

Discussion

The results of the study suggest that participants' vicarious and mastery experiences of successful computer and Internet activities had an impact on their CSE. Bandura (1997, 2001) indicated that changes in self-efficacy can be caused through vicarious experiences, modeling, and mastery experiences. Bandura and Adams (1977) described vicarious experiences as experiences of participants' observing others demonstrate a particular action or behavior. Wood and Bandura (1989) described mastery as "performance successes" and explained that effective mastery experiences provide performance successes in combination with experiences in overcoming obstacles through perseverance. Bandura (1997, 2001) further indicated that vicarious experiences of mastery provided through modeling of successful activities by others, coupled with participant modeling of successful performances, can promote self-assurance, skill acquisition, and self-directed success, in addition to having a positive impact on self-efficacy of participants. Furthermore, Bandura (1986) advocated training with a focus on improving students' actual skills through modeling, successful hands-on experiences, and positive verbal feedback for increasing their self-efficacy.

CompNow program participants received vicarious experiences and modeling of successful computer experiences while observing the program instructor conduct demonstrations of computer disassembly and reassembly, installation of Windows operating system, and completion of software tasks. Participants received successful hands-on experiences during the program by conducting several exercises relating to the

physical examination of computer hardware, repeatedly removing and replacing hardware, installing software, conducting Internet searches, and software exercises. Furthermore, the participants obtained some mastery experiences when they successfully completed the test on disassembling and reassembling computer hardware and installed software on their computers. Additionally, participants received authentic feedback from the computer while conducting hands-on exercises. For example, when a participant removed a certain hardware component from the computer during the disassembly process and subsequently reassembled the computer without that component, the computer would sound a warning or would refuse to start when powered on. Participants also received consistent and encouraging verbal feedback from the program instructor while conducting these hands-on activities.

The modeling of successful computer tasks by the program instructor afforded vicarious experiences for participants who observed these demonstrations. Program exercises involving hands-on tasks relating to computer hardware, software, and the Internet afforded mastery experiences for those who diligently completed them. The study did not find differences between the experiences of target and non-target populations. The researcher observed that both non-target population participants (Corey and Dacey) and target population participants (Josh, Kaycee, Madison, and Rizzo) utilized these opportunities during the program and increased their CSE beliefs, thus suggesting that the program attributes highlighted in this section had a positive effect on many participants' CSE scores at the end of the program. Additional exercises promoting the use of digital media and the participatory culture of the Internet among participants could have strengthened participants' CSE beliefs in digital media.

Implications

The inclusion of vicarious and mastery experiences in the curriculum for programs such as CompNow can help increase CSE beliefs, computer literacy, and Internet literacy among participants. The CompNow program provided affordances for modeling successful performance of computer tasks by program instructor and participants. The inclusion of vicarious and mastery experiences relating to the participatory culture of the Internet as explained by Jenkins et al. (2006) and digital media literacy as explained by Warschauer (2010) could further enhance the impact of programs such as CompNow.

Future Research

The study found that a key 21st-century skill relating to computer and Internet literacy was improved by the program. However, a larger study is needed along with a control group to determine more accurately the extent to which programs such as CompNow affect computer and Internet literacy among middle-school students. Further research is also needed to explore how current digital media and social networking tools could be utilized to provide vicarious and mastery experiences for effective participation in online environments.

PARENTAL SUPPORT AND COMMITMENT

Bandura and his fellow researchers (Bandura et al., 1996) found that parents' goals for their children significantly affected their self-efficacy beliefs, while Vekiri and Chronaki (2008) found that parental support strongly affected boys' and girls' computer self-efficacy and value beliefs. The study suggests that parental support and commitment had a positive impact on their children's CSE beliefs, while negative parental perceptions

about their children's computer usage and/or skills had a detrimental effect on their CSE beliefs.

Instances of parents' helping their children compensate for unexpected absences from program sessions by driving them the following day to attend early morning make-up sessions at school, and instances of parents' expressing positive opinions about their children's computer activities both during the program and at home were considered demonstrations of strong parental support. The researcher observed that children who enjoyed strong parental support enhanced their CSE beliefs through the program and, in most cases, scored higher than the average CSE score. One of the program participants, Rizzo, experienced very strong support and commitment from his parents during the program and experienced the highest increase in his CSE scores to obtain the joint-highest post-program score on CSE beliefs. Kaycee, along with Madison, Dacey, and Josh also experienced support and encouragement from their parents and increased their CSE scores at the end of the program as well.

In one instance where Danny's dad was not very supportive of his computer activities, the researcher observed that Danny's CSE beliefs were low before and after the program. Danny's dad was critical about his son's use of the computer for gaming and stated that his son should be learning how to create computer games rather than just play them. During the course of the CompNow program, Danny's dad was unimpressed with his son's progress in computer learning. This could explain the reason why Danny scored lower than the mean score on both his pre-program and post-program CSE beliefs and demonstrated very little change in his CSE beliefs.

Hsu and Huang (2000) found that the home environment has an indirect impact on students' CSE. This study found that participants who had a supportive computer learning environment and already had a computer and internet connection in their homes

entered the program with higher CSE than the others and continued to enhance their CSE during the program. Parents of participants from target populations could therefore benefit from opportunities to gain computer skills and access computers. The study suggests that an opportunity for parents of program participants from target populations to receive training in computers and the Internet could help them improve their own employment opportunities as well as create a home environment which fosters increased computer use. Some parents expressed a desire to participate in programs which helped them learn about computers along with their children. Parents of participants such as Josh, Madison, and Kaycee had no computer experience, held irregular or low-paying jobs, and expressed an interest in learning about computers. *Computers for Youth* (Kalra, 2004) and *Technology Goes Home* (Finn et al., 2004) are examples of such programs that provided access, training, and support both to students and their parents. A supportive home environment which encourages parental support for their children's computer activities could further strengthen the impact of the program on participants' CSE.

Implications

Parental support and commitment toward their children's computer activities during the program and at home seemed associated with increased CSE beliefs of program participants. However, the CompNow program did not encourage interactions between program participants and their parents. Therefore, programs such as CompNow must undertake efforts to encourage increased interaction between program participants and their parents during the program. Feedback mechanisms such as online blogs and formal feedback forms could be used to encourage input from parents on their children's computer activities during the program. Additionally, efforts to include target population parents in the program need to be explored, as some of those parents in this study

expressed a desire to participate in programs which would help them learn about computers.

Future Research

Finding new ways of increasing equitable access to computer and Internet technology to parents of middle school students is an area that is ripe for additional research. By providing increased computer access and enhancing their computer and Internet skills, and by fostering their involvement in the participatory culture of the Internet, CSE beliefs of both parents and children from underserved communities could be enhanced.

CONCLUSIONS

This study sought to investigate the impact of an after-school program which provided a desktop computer to middle-school students from underserved communities who completed a ten-week computer training course. The study examined the program's impact on participants' CSE beliefs as well its impact on digital equity. This inquiry generated information about the perceptions of participants and their parents about the program, as well as the quality and usefulness of the computer received at the end of the program. Results of the study showed that the CompNow program did not change participants' CSE beliefs in a statistically significantly way, but the majority of participants experienced some increase in their CSE beliefs at the end of the program. The study also revealed that participants interviewed by the researcher expressed increased confidence in computers, spent more time on computers at home, and were able to resolve home computer issues. Parents were happy with the CompNow program as well and generally expressed increased confidence in their children's computer skills.

The study identified some of the program attributes which apparently led to enhanced CSE beliefs in most participants. These included vicarious and mastery experiences during the program including hands-on experiences and teacher demonstrations of computer skills. The study found that parental support of and encouraging feedback to the student's computer activities during the program had a positive impact on participants' CSE beliefs, while negative parental input resulted in a negative impact. However, the program seemed to have stopped short of making progress on its goal of bridging the digital divide through access to computers and Internet access because it provided refurbished but old desktop computers which included outdated hardware of varying quality, software limited to documents creation, spreadsheet-based analysis and presentations, and one year of free dial-up Internet service to program participants. While the hardware was generally perceived to be of poor quality and barely functional by program participants, the software was hardly used by program participants since they generally used the program computer for playing games, and/or playing and editing music, games, and videos. The dial-up Internet service was not used by any of the participants interviewed for this study either because they did not have a phone line or already had high-speed Internet service at home.

Program participants received basic, hands-on training on computer hardware disassembly and assembly, installation of Windows operating system, basic operations of MS Office software, and basic Internet search. While these skills increased their computer and Internet literacy, an important 21st-century skill, the training did not foster the development of literacy in mobile digital media and skills in online community participation. Additionally, the program failed to provide opportunities for multimedia skills development and the use of computer-based play activities for problem solving. Furthermore, culturally–responsive content was not included in the program's

curriculum. Such inclusion could have fostered culturally relevant computer and Internet experiences for the program's participants.

The table below provides a summary of the recommendations provided by the study that could enhance the impact of the CompNow program at the school included in the study. A table that includes the program impact and limiting factors of the program is provided in Appendix I.

Table 2: Recommendations to Enhance Impact of CompNow Program included in Study

Program Attribute	**Recommendations**
Computer Hardware	1. Strengthen supply of good quality computers by strengthening partnerships with private sector 2. Provide clean and working computers that are 3-years old or newer, RAM: 2 GB or higher, Processor: 1 GHz or higher, Hard Disk: 150 GB, Current Graphics driver, keyboard, monitor, mouse, speakers, wireless Hi-speed Internet card 3. Computer-specific documentation including system information and maintenance tips 4. Printer with 1-year supply of ink, if possible
Internet Service	1. Provide high-speed Internet service, preferably wireless
Software	1. Provide free and/or open source multimedia software such as DVDx (video editor), Picasso (image editor)

Learning Content	1. Include use of social networking tools in program curriculum (such as Facebook, MySpace) 2. Include tasks such as creation of wikis, contributing to a blog in program curriculum 3. Provide learning opportunities for participants to create multimedia content, understand content copyright issues and share their creations with others 4. Tasks to search images, personalities, and historical facts relevant to the participants' demographics (Hispanic, African-American, Asian and Caucasian in this case) could replace some of the search exercises in the program workbook. Opportunities could be provided for participants to analyze the results and understand how it relates to their lives outside the classroom.
Target Population	1. Conduct a rigorous review of the participants' profiles to determine if the participant mix found in this study was a regular occurrence 2. If so, the program instructor could utilize participants from non-target populations in a "helper" role and foster the transfer of those participants' computer knowledge and experience to participants from target populations
Computer Self-Efficacy	1. Include hands-on exercises that enhance the CSE of participants in the areas of online participation and multimedia use

	2. Provide opportunities for vicarious and mastery experiences for successful online participation and multimedia use

At a time when the digital world is moving beyond the desktop to mobile devices and high-speed wireless Internet connectivity, digital equity-focused programs such as CompNow need to transform their programs in order to bridge the new digital divide involving equitable access as well as training and opportunities to use, learn, and benefit from the participatory culture of the Internet so that young students along with their parents can use and create digital content using social media in productive and effective ways. New partnerships might have to be forged between for-profit companies, non-profit organizations, public agencies, and academia to transform programs such as CompNow to bridge the digital divide which continues to exist in our society today.

Appendix A: Survey Questions

1. Which of the following most accurately describes your involvement with the Hi-Tec CompNow program? (Please check all that apply)

    a. District Coordinator
    b. Instructor
    c. Partner
    d. Technical Director
    e. District Administrator
    f. District Superintendent
    g. District PR Officer
    h. Other

2. How many semesters have you personally participated or been involved in the program?
3. Through what school district did you participate in Hi-Tec CompNow?

5-point Lickert Scale for the following questions

(Strongly Disagree, Disagree, N/A, Agree, Strongly Agree)

4. Hi-Tec's Instructor Manual and other materials for instructors were helpful and relevant.
5. Hi-Tec's District Implementation Manual and other materials were helpful and relevant to establishing your Hi-Tec CompNow program
6. The software Hi-Tec arrived in a timely fashion.
7. The computers Hi-Tec committed to us arrived in a timely fashion.
8. How would you rate the quality of the equipment (hardware) this semester?
9. Compared to last semester, do you feel that you have seen an improvement in the equipment quality?
10. The modems Hi-Tec committed to us arrived in a timely fashion.
11. The Hi-Tec personnel I worked with were competent and helpful.
12. The Instructor Training session was useful.
13. Subsequent Hi-Tec led instructor training sessions were useful.
14. The Hi-Tec CompNow curriculum is of appropriate scope and difficulty.
15. The Hi-Tec CompNow curriculum is written and structured such that it is easy to teach.
16. The Hi-Tec CompNow curriculum is relevant to the students' academic pursuits and/or intellectual development.
17. Our students have developed a greater intellectual curiosity.
18. Our students have developed a greater capacity towards computers and/or technology
19. Our students seem more confident in their personal abilities.
20. This program made a difference in the lives of our students.

21. The parents of our students believe this program was valuable.
22. Our students have been able to demonstrate 21st Century Skills such as teamwork, collaboration and critical thinking.

Open-ended questions

23. Based on your experience what particular measures or resources could Hi-Tec commit to ease the implementation of Hi-Tec CompNow into NEW Districts?
24. In the future, what measures or resources could Hi-Tec provide to ease the implementation of Hi-Tec CompNow into RETURNING Districts?
25. What aspects of the current Hi-Tec CompNow program most need improvement?
26. Overall do you feel Hi-Tec CompNow was a worthwhile investment for your District?
27. Would you recommend Hi-Tec CompNow to other school districts?
28. If the decision were left to you would you recommend that your District participate in Del CompNow again in the future?
29. Do you personally want to participate in the Hi-Tec CompNow program again in the future?
30. Any further comments?

Appendix B: Computer Self-efficacy Questionnaire

Table 3: Computer Self-efficacy Questionnaire

A	Name						
B	Grade You Are In	6th	7th	8th			
C	Your Gender	Male	Female				
D	Have You Used Computers Before	Yes	No				
E	Do You Own A Computer	Yes	No				
F	Have You Ever Attended A Computer Training Course	Yes	No				
	Below you will find a number of statements concerning how you might feel about computers.						
	Please indicate if you agree/disagree with the statements using the 6-point scale shown below.						
	Circle the number between 1 and 6 that most closely represents how much you agree or disagree with the statement.						
	There are no correct responses, it is your own views that are important.						
#	Response Item	Strongly Disagree	Mostly Disagree	Somewhat Disagree	Somewhat Agree	Mostly Agree	Strongly Agree
1	I can usually deal with most computer problems.	1	2	3	4	5	6
2	I find it very easy to work with computers.	1	2	3	4	5	6
3	I am not sure of my abilities to use computers.	1	2	3	4	5	6
4	I seem to have difficulties with most software I have tried to use.	1	2	3	4	5	6
5	Computers frighten me.	1	2	3	4	5	6
6	I enjoy working with computers.	1	2	3	4	5	6
7	I find it difficult to learn other subjects in school using computers.	1	2	3	4	5	6
8	I find the internet very easy to use.	1	2	3	4	5	6
9	Computers make me much more productive in school.	1	2	3	4	5	6
10	I often have difficulties when trying to learn how to use new computer software.	1	2	3	4	5	6
11	Most of the computer software I have used before, have been easy to use.	1	2	3	4	5	6
12	I am very confident in my abilities to use computers.	1	2	3	4	5	6
13	I find it difficult to get computers to do what I want them to do.	1	2	3	4	5	6
14	At times I find working with computers very confusing.	1	2	3	4	5	6
15	I do not like to learn how to use computers.	1	2	3	4	5	6
16	I usually find it easy to learn how to use a new software package.	1	2	3	4	5	6
17	I seem to waste a lot of time struggling with computers.	1	2	3	4	5	6
18	Using computers makes learning more interesting.	1	2	3	4	5	6
19	I always seem to have problems when trying to use the internet.	1	2	3	4	5	6
20	Some computer software definitely make learning easier.	1	2	3	4	5	6
21	I do not understand how computers work.	1	2	3	4	5	6
22	Computers are far too complicated for me.	1	2	3	4	5	6
23	Using computers is something I rarely enjoy.	1	2	3	4	5	6
24	Computers help me to learn better.	1	2	3	4	5	6
25	Sometimes I don't know why things happen when I'm using the computer.	1	2	3	4	5	6
26	As far as computers go, I don't consider myself to be very competent.	1	2	3	4	5	6
27	Computers help me to save a lot of time.	1	2	3	4	5	6
28	I find working with computers very frustrating.	1	2	3	4	5	6
29	I consider myself to be a skilled computer user.	1	2	3	4	5	6
30	When using computers I worry that I might press the wrong button and damage it.	1	2	3	4	5	6

Scoring the Computer Self-Efficacy Scale

- Experience with computers—This question is scored using a standard Likert format where "none" is scored as 1 and "extensive" is scored as 5.
- Items 1 to 30 are all scored on a 6-point Likert scale.
- Items 1, 2, 6, 8, 9, 11, 12, 16, 18, 20, 24, 27, and 29 are positively worded and the respondent's response is recorded as the actual scale score for these items, e.g., a response of 4 to item 1 will be scored as 4, i.e.
- Strongly Disagree 1 2 3 4 5 6 Strongly Agree
- Items 3, 4, 5, 7, 10, 13, 14, 15, 17, 19, 21, 22, 23, 25, 26, 28, and 30 are negatively worded and are scored in reverse, i.e.
- Strongly Agree 1 2 3 4 5 6 Strongly Disagree
- A scale score for these items is obtained by subtracting the respondent's response from 7, e.g., a response of 4 to item 3 will be scored as 3.

Summing the scores for all 30 items gives the total self-efficacy score. Using this scoring method, a high total scale score indicates more positive computer self-efficacy beliefs.

Appendix C: Guided Questions for Interview

The author prepared a set of questions that would help the author interview the study's participants and included the following:

1. How did you hear about the CompNow Program?
2. How were you chosen for the CompNow Program?
3. Had you worked with computers prior to your participation in this program? If so, provide details.
4. What did you like the most about this program - Instructor, Working with Computers, The learning process, or Taking a computer home?
5. How have you used the computer after bringing it home?
6. How has your family used the computer after bringing it home?
7. Have you taught others how to use computers since graduating from the class?
8. Have you taken other technology classes since Hi-Tec CompNow?
9. As a result of the program did you learn useful skills?
10. As a result of the program have a greater interest in computers?
11. As a result of the program were you more confident in your personal abilities - such as accomplishing tasks, speaking in public, etc.?

Appendix D: Consent Form for Participants and their Families

Informed Consent to Participate in Research
The University of Texas at Austin

You and your child are being asked to participate in a research study. This form provides you with information about the study. The Principal Investigator (the person in charge of this research) or his/her representative will provide you with a copy of this form to keep for your reference, and will also describe this study to you and answer all of your questions. Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part. The participation of you and your child is entirely voluntary and you can refuse to participate without penalty or loss of benefits to which you are otherwise entitled.

Title of Research Study
Impact of Hi-Tec CompNow program on its participants and their families

Principal Investigator(s) (include faculty sponsor), UT affiliation, and Telephone Number(s)
Ravi Narayan, PhD student, College of Education, UT Austin. Telephone: 512-470-1264
Faculty Sponsor: Paul Resta, PhD, Ruth Knight Millikan Centennial Professor in Instructional Technology and Director of the Learning Technology Center at UT Austin. Telephone: 512-471-3610

Funding source: Not Applicable

What is the purpose of this study?
Your child had participated in a program called Hi-Tec CompNow at your middle school and had an opportunity to earn a refurbished home computer and learn technology skills to better prepare you for opportunities in today's technology driven world. This program was conducted as an after-school, 40-hour, self-paced, hands-on course where they work in teams to learn computer basics. The main aims of this program were to help middle school-age children, like your child, to develop 21st century technology skills, expand their intellectual curiosity, increase their self-esteem, and become coaches and mentors to other family members who may lack technology skills. While surveys conducted by Hi-Tec CompNow personnel at the end of each session of the program have provided positive feedback about the program, researchers feel that it would be useful to obtain more detailed thoughts from the learners and their families about the program and its perceived impact on the learners' ability to develop 21st century skills.

This pilot study will conduct a qualitative analysis of the program's impact on students and their families and the program's impact on the students' ability to develop 21st century skills. It is expected that 5-10 students will be included in this study.

What will be done if you take part in this research study?
A survey will be conducted with the student before and after the program that attempts to understand the students' confidence in their computer skills. After the program is completed, an interview will be conducted with you and your child wherein the researcher will ask you and your child a few questions about his/her participation in the program and how it has impacted you and your child after your completion of the program. You and your child will choose the day(s), time(s) and place(s) of the observation(s) and interview(s). If you and your child choose to meet at your home or at a non-public place, you will be given at least twenty-four hours' notice prior to my arrival at your home or other non-public places where you will be interviewed. This interview will be recorded using an audio recorder and will be transcribed into a written transcript. Any personal information that can reveal your identity will be removed from the transcript. These artifacts will be kept under lock and key at UT Austin. The interview transcripts will then be analyzed to understand the impact of the program. The results of this analysis will then be published in a report that will be made available to the researcher's faculty sponsor at UT, CTSD, and Hi-Tec, Inc. Any personal information that identifies you or your child will be excluded from the report.

The Project Duration is: 3 months

What are the possible discomforts and risks?
There are no possible discomforts and risks identified with this research study at this time. If you wish to discuss the information above or any other risks you may experience, you may ask questions now or call the Principal Investigator listed on the front page of this form.

If you or your child feel distressed while participating in the study, you should contact the school counselor at your child's school.

What are the possible benefits to you or to others?
This will enable us to understand the impact of this program and to determine ways in which programs such as Hi-Tec CompNow can be made better for future participants.

If you choose to take part in this study, will it cost you anything?
There is no cost to you and your child for participating in this study.

Will you receive compensation for your participation in this study?
No compensation will be provided for your and your child's participation in this study.

What if you are injured because of the study?
The researcher does not anticipate any injuries whatsoever because of the study. The University has no program or plan to provide treatment for research related injury or

payment in the event of a medical problem. In the event of a research related injury, please contact the principal investigator.

If you do not want to take part in this study, what other options are available to you?
Your and your child's participation in this study is entirely voluntary. You and your child are free to refuse to be in the study, and your refusal will not influence current or future relationships with The University of Texas at Austin and or CTSD.

How can you withdraw from this research study and who should you call if you have questions?

If you wish to stop your and your child's participation in this research study for any reason, you should contact the principal investigator: Ravi Narayan at (512) *470-1264*. You should also call the principal investigator for any questions, concerns, or complaints about the research. You are free to withdraw your consent and stop participation in this research study at any time without penalty or loss of benefits for which you may be entitled. Throughout the study, the researchers will notify you of new information that may become available and that might affect your decision to remain in the study.

In addition, if you have questions about your rights as a research participant, or if you have complaints, concerns, or questions about the research, please contact Jody Jensen, Ph.D., Chair, The University of Texas at Austin Institutional Review Board for the Protection of Human Subjects at (512) 232-2685 or the Office of Research Support and Compliance at (512) 471-8871.

How will your privacy and the confidentiality of your research records be protected?
The responses to the survey will be stored in paper form in a locked file cabinet in the investigator's office at UT Austin. These responses will then be transferred to an electronic database for analysis – however, no personal information will be used for analysis and will not be published in any form. The interviews will be recorded on digital media. The data will be coded so that no personally identifying information is visible on them. They will be kept in a in a locked file cabinet in the investigator's office at UT Austin. They will be heard only for research purposes by the investigator and his faculty sponsor. Any personal information that can reveal your identity will be removed from the transcript. No personal information will be shared with Hi-Tec CompNow personnel or CTSD.

If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, then The University of Texas at Austin will protect the confidentiality of those records to the extent permitted by law. Your research records will not be released without your consent unless required by law or a court order. The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will

contain no identifying information that could associate you with it, or with your participation in any study. If the researcher(s) should observe child or elder abuse, confidentiality will be broken. State law requires the reporting of abuse to relevant agencies such as Child Protective Services or the Texas Department of Family and Protective Services.

Will the researchers benefit from your participation in this study*?*
No benefits are anticipated to the researcher beyond the publication and/or presentation of the results.

Signatures:

As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

Signature and printed name of person obtaining consent Date

You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. Your signature below indicates that you have read the material above and have agreed to participate and allow your child to participate in this study. You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights.

Printed Name of Subject Date

Signature of Subject Date

Signature of Principal Investigator Date

If the results of this research are published or presented at scientific meetings, your identity will not be disclosed. We may wish to present some of the audio / video tapes from this study at scientific conventions or as demonstrations in classrooms. Please sign below if you are willing to allow us to do so with your recorded data.

Printed Name of Subject Date

Signature of Subject Date

Signature of Principal Investigator Date

Address, City, State, Zip

Appendix E: Code Book for Qualitative Analysis

Table 4: Code Book for Qualitative Analysis

Level 1 Code	Level 2 Code	Level 3 Code	Level 4 Code	Level 5 Code	# of References	Description
Computer Location at Home						Location of the program computer at the participant's place of residence.
	Absent				0	
	Outside Student Room				1	
	Student Room				4	
Computer Self-Efficacy						Perceptions of Computer self-efficacy provided by participants and their families. Comparative codes for Participants' CSE scores on questionnaire were developed as well.
	Family Belief in Student CSE				19	
	Student CSE Perception				13	
	Student CSE Score				27	
		After Program CSE Decrease			0	
		After Program CSE Higher Than Sample Mean			5	
		After Program CSE Increase			7	
		After Program CSE Lower Than Sample Mean			3	
		Before Program CSE Higher Than Sample Mean			3	
		Before Program CSE Lower Than Sample Mean			4	
Family Background						Background information about the participant's family including their aspirations, other members in Participants' family, family's computer background as well as their occupations.
	Aspirations				6	
	Community				17	
	Computer Background				26	
	Not Afford A Computer				5	
	Occupation				11	
Family Computer Perception						Opinions expressed by the participant family members regarding the computer provided by the program
	Convenient				2	
	Expensive to Maintain				3	
	Inconvenient				0	
	Inexpensive to Maintain				0	

	Not Useful				4	
	Not Working				0	
	Outdated-Requires Upgrade				9	
	Useful				4	
	Working				0	
Family Computer Usage						Family members discussing their activities undertaken on their computers (both program and non-program computers).
	Computer Activity				0	
		Browse Internet			1	
		Education-Training			3	
		Play			3	
		Work-Career			1	
	Computer Management				0	
		Computer Time Management			0	
		Sharing			2	
	Use Non-program Computer				4	
Family Program Perception						Impact and Perceptions of the program expressed by participants and their families
	Bad				0	
	Deeper Learning Required				4	
	Enhance				5	
	Extend				8	
	Good				14	
	Interested in Additional Programs				7	
	Make-up Sessions				2	
	Neutral				0	
	No Change				1	
	Promote Digital Equity - Computer Access				3	
	Recommend				1	
	Teacher Role				3	
General Computer Feelings					0	Beliefs and Attitudes towards computers expressed by participants and their families
	Family Belief in Computers				10	
	Family Belief in Student Computer Future				13	
	Student Attitudes Towards Computers				19	
	Student Interest in Computers				21	
ICT Literacy					0	Expressions of Literacy with

	Computer Hardware Knowledge				98	regards to Information, Communications and Technology
	Computer Software Knowledge				108	
	Family ICT Literacy				4	
	Internet Knowledge				14	
Motivation for Program					0	Opinions expressed by participants and families regarding the motivations for joining/completing the program.
	Brand				1	
	Family				6	
	Learning Interest				8	
	Obtain Computer				7	
	School Teacher				3	
	Self-Interest				8	
Program Commitment					0	Commitment of participants and their families during the course of the program
	Family				4	
	Student				7	
Program Workbook					0	Comments on the program workbook by participants and/or their families
	Neutral				2	
	Not Useful				1	
	Useful				5	
Student Background					0	Background information of Participants
	Aspirations				29	
	Friends With Computers				4	
	In-Program Student Class Level				5	
	Personal				25	
Student Class Perception					0	Participants' perception of their in-class experience of the program.
	Bad				0	
	Boring				0	
	Fun				3	
	Good				8	
	Neutral				0	
Student Computer Experience					0	Participants' experiences with computers - both with the computer provided in the program and other computers at their home. Codes were developed to account for students obtaining increased access to a computer, ways in which the computer was used, their experiences with computer hardware, software and the Internet. Codes were also included to account for time spent
	Access To Computers				12	
	Computer Activity				7	
		Educational			5	
		Play			25	
		Scholarship-Money			2	
	Computer Hardware Experience				11	
		Added Hardware			8	

		Components				on the program computer and to determine whether participants spent time on a non-program computer after receiving the program computer. A code to help determine whether the program computer was their first computer was included as well.
		Bad			0	
		Good			9	
		In-Class Activity			39	
		Neutral			1	
	Computer Software Experience				6	
		Add-Remove software			4	
		Bad			1	
		Good			4	
		In-Class Activity			31	
		Neutral			1	
	Computer Time				20	
	First Personal Computer				5	
	Internet Experience				0	
		Internet Access			0	
			Computer Issues Prevent Access		3	
			Dial-up Access		4	
				Unused- Have High-speed Access	6	
				Unused-No Phone Line	2	
			Not Present		4	
			Present		5	
		Internet Activity			2	
			Search		6	
			Video		0	
			Web Sites		8	
	Non-program Computer				14	
Student Computer Perception					0	Opinions expressed by the participant regarding the impact and condition of the program computer.
	Convenient				2	
	Expensive to Maintain				1	
	Inconvenient				0	
	Inexpensive to Maintain				0	
	Not Useful				6	
	Not Working				0	
	Outdated-Requires Upgrade				8	
	Slow				4	
	Useful				6	
	Working				5	

Student In-Class Experience					0	In-Class experience observed by researcher or discussed during interview. This included any hands on experiences as well as Participants' behavior during the program sessions.
	Hands-on Computer Experience				81	
	Student Class Presence				24	
Student Program Perception					0	Impact and perceptions expressed by participants about the program
	Bad				1	
	Enhance				4	
	Extend				0	
	Good				17	
	Neutral				0	
	No Change				1	
	Recommend				2	
	Teacher Role				1	
Student Social Role					0	Impact of the program and computer on the role of student with family and friends. Codes to identify the nature of these roles were developed to include activities relating to collaboration with others, helping others, teaching and general interaction. Family, Friends and Teachers were the three groups considered for coding.
	Collaborate				0	
		Collaborate Family			2	
		Collaborate Friend			2	
		Collaborate Teacher			0	
	Help				2	
		Help Family			6	
		Help Friend			0	
		Help Teacher			1	
	Interact				0	
		Program Participant Interaction			9	
		Student Family Interaction			6	
		Student Teacher Interaction			3	
	Teach				4	
		Teach Family			7	
		Teach Friend			1	
		Teach Teacher			0	

Appendix F: T-Test Details

Null Hypothesis: No difference exists between pre-program CSE and post-program CSE

Alternate Hypothesis: Difference exists between pre-program CSE and post-program CSE

Table 5: T-Test Details

Participant	**Pre-Program CSE**	**Post-Program CSE**	**Difference**
Abe	154	162	-8
Carey	145	161	-16
Cannan	143	138	5
Dacey	144	151	-7
Danny	130	132	-2
Josh	164	169	-5
Judas	142	125	17
Kaycee	114	136	-22
Lang	112	126	-14
Madison	134	145	-11
Marvin	121	108	13
Rizzo	130	169	-39
Shaw (not used in T-Test)	124		124
Jalen (not used in T-Test)		155	-155
Mean	136.08	143.5	-7.42
Median	138	141.5	0
Mode	130	169	39
Standard Deviation	15.66	19.39	3.72
Variance	245.36	375.91	
Std Error of the Difference			7.20
Risk Level (Alpha Level)			0.05
Degrees of Freedom			22
T-Test Result: Null Hypothesis Accepted			(t=-1.03, 22 d.f., P=0.12)

Appendix G: Wilcoxon Signed-Ranks Test Details

Null Hypothesis: No difference exists between pre-program CSE and post-program CSE

Alternate Hypothesis: Difference exists between pre-program CSE and post-program CSE

Table 6: Wilcoxon Signed-Ranks Test Details

Participant	Pre-Program CSE	Post-Program CSE	Sign of Difference	Difference	Absolute Difference	Rank of Absolute	Signed Rank
Abe	154	162	-	-8	8	5	-5
Carey	145	161	-	-16	16	9	-9
Cannan	143	138	+	5	5	2.5	2.5
Dacey	144	151	-	-7	7	4	-4
Danny	130	132	-	-2	2	1	-1
Josh	164	169	-	-5	5	2.5	-2.5
Judas	142	125	+	17	17	10	10
Kaycee	114	136	-	-22	22	11	-11
Lang	112	126	-	-14	14	8	-8
Madison	134	145	-	-11	11	6	-6
Marvin	121	108	+	13	13	7	7
Rizzo	130	169	-	-39	39	12	-12
Shaw	124		N/A	124	N/A		
Jalen		155	N/A	-155	N/A		
Test Result: Null Hypothesis accepted							W+ = 19.5
							W- = 58.5
							P-Value = 0.07

Appendix H: Background for the Study

A comprehensive analysis of the teacher and administrator responses contained in the surveys conducted by the Hi-Tec CompNow team on the program was conducted by the researcher in the spring of 2006. The survey was intended to obtain feedback from district personnel who conducted the program at their district and is shown in Appendix A. The questions in the survey were designed to: 1) provide Hi-Tec with feedback on the logistical aspects of the program and, 2) to understand their perceptions of the effects of the program on the learners. The questionnaire was developed by Hi-Tec and was comprised of 30 questions. 8 questions pertained to the curriculum and its impact on the students, 6 questions pertained to program logistics, 3 questions pertained to instructor training, 3 questions pertained to the respondents' background and the remaining questions encouraged the respondents to provide perception on the program in general.

The surveys were conducted at the time of completion of the program at various schools around the nation, during the semesters of Fall 2005, Spring 2006 and Summer 2006. The data was collected using a paper-based form and then transferred to Excel files by Hi-Tec personnel. The questionnaires were mailed to the school personnel who participated in the program. The participants then mailed the responses back to Hi-Tec program personnel. These responses were then entered into an Excel file and then transferred to a CD.

The survey respondents included 129 participants spread over three semesters of the academic school year. There were 19 respondents in Fall 2005, 76 respondents in Spring 2006, and 32 respondents in Summer 2006. The respondents were school personnel who conducted the program at their school and were from various locations within the US. Some respondents participated more than once in the program (in Fall

2005 and Spring 2006, for instance). 102 respondents were instructors, 13 respondents were district coordinators, and the rest were in other positions. 4 out of the 102 instructors were district coordinators as well and 4 of the 102 instructors were technical directors as well.

A descriptive analysis of the data found that the administrators and teachers have positive perceptions related to not only the curriculum of the program but its effects on students. This was further exemplified by the high level of concurrence in the perceptions of teachers and administrators that the CompNow program represented an excellent investment of the school district efforts. They also indicated very strongly that they would recommend the program to their other districts and would like to continue their participation in the program. Open-ended comments were consistent with the quantitative survey data as respondents noted their positive view of the program. The participant responses also demonstrated a clear perception amongst the administrators and teachers that the program was able to achieve its goal of helping students to develop their intellectual curiosity and capacity in the use of computer technology.

The researcher felt that it was important to now undertake a rigorous study to understand the impact of the program on the participants themselves. Additionally, it was felt important to understand how the entry of a computer in participants' homes affects them and their families. Most of the participants have had limited/no access to computers at home and a review of the literature showed that availability of computers at home was a key factor in enhancing digital equity in learning environments. To determine the feasibility of such a study, it was determined that a pilot study to qualitatively assess the impact of the program on its participants and their families would be conducted.

The researcher undertook a first-hand observation of the program in action to gain increased understanding of the Hi-Tec CompNow program and chose to do so at Central Texas Middle School (CTMS). The Hi-Tec CompNow program has been in existence at CTMS since 2002 – in fact, CTMS was one of the first CTISD participants in this program. The instructor who conducted the program during the past 5 years retired at the beginning of 2007-08 school year and Mr. Richardson stepped in to conduct the program for the first time this year. He was an athletic coach at the school and also a keen technology enthusiast.

The author sat in the last two sessions of the latest iteration of the program at CTMS that began in October 2007 and ended in December 2007. A review of the program curriculum kindly provided by Mr. Richardson indicated that the program was divided into two phases – computer hardware topics were taught during the first phase and computer software was taught during the second phase. The program's participants received a refurbished desktop from Hi-Tec, Inc. at the beginning of the program. During the first phase of the program, the students disassembled and reassembled the computer several times to enable them to develop adequate skills in computer hardware maintenance. During the second phase of the program, the students received software and training relating to Internet connectivity (AOL), office software (MS Office) and operating system (Microsoft XP Home). This training was held at the school's computer lab and focused on helping the students develop their technical skills relating to the use of the programs themselves. Reading and writing tasks that focused on increasing the students' technology awareness were provided as well. Additionally, the curriculum made provisions for students to make reflective notes about the topics they had learned about. They did so twice during the program.

The program's participants met for 2 hours, two times a week for 10 weeks. The program was conducted in a science lab with a seating capacity of about 30 people. The lab equipment was stashed away in closets to make room for the computers and monitors and also to minimize distractions for the program participants. In addition to Mr. Richardson, a volunteer (sometimes two) from Hi-Tec, Inc. provided mentorship to the students during each session of the program. Each volunteer from Hi-Tec, Inc. was available for the entire length of the program so that the students could develop a truly beneficial relationship with the volunteer(s). During each session, the students reviewed written content prepared by program personnel, interacted with the computer and then participated in group activities with other students in the class consisting of helping their peers learn about the hardware/software and test them on their subject matter knowledge. For example, in one session that focused on the motherboard, the heart of the computer, students initially interacted with Mr. Richardson and read printed content. They then worked with the motherboard housed in their own computer and finally discussed this topic with other members of the class. In another session, the students learned about MS Power Point in a similar manner. The researcher observed that each participant was randomly assigned to a working computer at the beginning of the program. They worked on that computer during the hardware portions of the class, installed the operating system on the computer and tested it to make sure that it was in working condition. They worked on the software exercises prescribed in the program at their school's computer lab where the computers were typically much newer and more powerful than the program computers.

The author attended the last two sessions of the latest iteration of the program during the first week of December 2007. The author observed that 90 percent of the students were Hispanic, the remaining 10 percent were White and that there were no

African-American participants in this iteration of the program. 7 girls and 12 boys were in the program. All the students could speak English fluently and had become quite comfortable with their computers as they had been working on them for the past 9 weeks. The students were seated in groups of four around a table and the girls were separated from the boys. The instructor indicated during an informal chat with the author that the students did not know each other before signing up for this program and it was very heartening to see them working together during the course of this program. Also, the boys were more vocal than the girls in this session.

During the first session that the author attended, the students learned about Internet security, information privacy and net etiquette. They also got a chance to get on their computer and explore security settings on their computer. The author noted that the students made observations such as the following:

"Can I change my User ID and password after setting up my account with America Online for the Internet connection?"

"If my uncle visits my home and wants to log into AOL, do I have to give them my User ID and password to him and if so, what happens if he goes to a bad website?"

The students seemed to have a good grasp of the idea that they would have a separate identity on the Internet but were connected to them in a very real way and that they would have to protect their identity in the online world as well. However, the instructor occasionally assigned them procedural tasks that did not seem to engage the participants very much. He also instructed each student to read a paragraph each from a set of guidelines on netiquette, Internet security and user identity. The students seemed rather disengaged during this exercise as well.

During the second session that the researcher attended, a graduation ceremony was held to enable the participants to get a 'Diploma' from Hi-Tec CompNow. The

graduation was held in the Library at CTMS and parents of most of the students attended the ceremony. Snacks were served at the end of the ceremony and some of the students' participants had brought some snacks and beverages as well. The parents who attended the ceremony and the students were very excited about getting a computer and couldn't wait to take them home! Some of the students made comments such as the following:

"The program was a lot of fun and I am looking forward to using the computer at home"

"I enjoyed learning about the hardware and might try to take my computer apart and put it together again at home"

The researcher also conducted brief interviews with the instructor, three participants and their parents. The study participants indicated that they enjoyed the program and felt that it was useful. However, it is essential to undertake a more rigorous study to meet with participants and their families at their homes so that a greater understanding of the impact of the computer's entry into their home can be gained. Also, an understanding of the program's impact on the participants' self-efficacy beliefs with regards to their computer skills would greatly enhance our understanding of the program impact as well.

Appendix I: Program Impact and Recommendations Summary

Table 7: Program Impact and Recommendations

Program Attribute	**Program Impact**	**Limiting Factors**	**Recommendations**
Computer Hardware	Increased computer access to target population	1. Varied and outdated configurations 2. Uneven quality and cleanliness 3. Wrong Expectations about computer quality	1. Strengthen supply of good quality computers by strengthening partnerships with private sector 2. Provide clean and working computers that are 3-years old or newer, RAM: 2 GB or higher, Processor: 1 GHz or higher, Hard Disk: 150 GB, Current Graphics driver, keyboard, monitor, mouse, speakers, wireless Hi-speed Internet card; 3. Computer-specific documentation including system information and maintenance tips 4. Printer with 1-year supply of ink, if possible

Internet Service	None	1. Target population did not have land line nor technical support to use it 2. Non-target population already had high-speed Internet	1. Provide high-speed Internet service, preferably wireless
Software	Provided access to open source software for document writing, drawing, spreadsheets and presentations	1. Software was not used very much both by target and non-target populations 2. Participants wanted to use multimedia software, but none was provided by program	1. Provide free and/or open source multimedia software such as DVDx (video editor) and Picasso (image editor)

Learning Content	1. Enhanced desktop computer, MS Office software and Internet literacy	1. Basic MS Office and Internet search skills were of limited use at home 2. Online participatory skills training was not included in the program 3. Culturally-responsive content missing from curriculum 4. Internet search tasks were too basic and focused on finding disparate, factual pieces of information	1. Include use of social networking tools in program curriculm (such as Facebook, MySpace) 2. Include tasks such as creation of wikis, contributing to a blog in program curriculum 3. Provide learning opportunities for participants to create multimedia content, understand content copyright issues and share their creations with others 4. Tasks to search images, personalities, and historical facts relevant to the participants' demographics (Hispanic, African-American, Asian and Caucasian in this case) could replace some of the search exercises in the program workbook.

			Opportunities could be provided for participants to analyze the results and understand how it relates to their lives outside the classroom.
Computer Self-Efficacy	1. 1. 9 out of 12 participants enhanced their CSE beliefs during the program 2. Provided vicarious and mastery experiences that enhanced CSE	1. By not including development of skills in multimedia use, mobile media and online participation, effect of CSE enhancement is limited in a world that is moving beyond the desktop 2. Parental involvement was not actively encouraged.	1. Include hands-on exercises that enhance the CSE of participants in the areas of online participation and multimedia use 2. Provide opportunities for vicarious and mastery experiences for successful online participation and multimedia use

Target Population	1. Program included participants from target and non-target populations	1. A stronger focus on including participants from program's target population could have strengthened program impact.	1. Conduct a rigorous review of the participants' profiles to determine if the participant mix found in this study was a regular occurrence. 2. If so, the program instructor could utilize participants from non-target populations in a "helper" role and foster the transfer of those participants' computer knowledge and experience to participants from target populations.

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