STUDENT TECHNOLOGY USE FOR POWERFUL LEARNING

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by
Carol Heidenrich

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Abstract

Technology has evolved as a valuable information and communication tool. In our knowledge and information society, students with information and communication technology (ICT) competence will be prepared for success. Teacher pedagogy and student learning have to change to fully integrate technology into the curriculum. Students may not have computers at home; teachers lacking adequate skills may prevent optimal use of technology for learning; students may not build ICT competence prior to high school graduation. The question focusing this research is, *In what ways have students experienced the use of technology tools for engaging in powerful learning experiences during the school day and outside of school?*

The problem of practice concentrates on students’ powerful learning experiences connected to technology use. I conducted an interview- and focus group–based qualitative study to examine this problem of practice. The theoretical component of this study comprised critical theory and online theory. The literature informed my inquiry leading to this study to understand the practices that build technology competence, how technology is being used in the classroom, and changing outdated classroom practices to fully integrate technology. The student voice was chosen for data gathering in this study. To provide the data analyzed for this study, 16 high school students participated in five semistructured interviews and two focus groups.

The major themes revealed in the data related to technology fostering independent and interdependent learning; the importance of teacher skill and comfort with technology; and the impact of technology access on opportunities for powerful learning. The study had three findings: (1) technology is more effective when infused into instruction for
learning than when used as an isolated tool; (2) access to technology impacts access to knowledge and learning; (3) differential access to technology has social equity and justice implications. Among the study’s recommendations were efforts to collaborate with students in school technology initiatives, reconfigure Internet content filters to unblock valuable learning resources for students, provide access to collaboration tools for instruction, and use a professional learning community for staff integration of technology.

**Keywords:** powerful learning, technology tools, digital literacy (competence), computer equity (digital divide), 21st-century skills.
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Nancy

Ted

Mary

Carmella

Focus Group Participants

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Independent Learning with Online Tutorials

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Chapter I:  
Introduction

Problem Statement

To succeed in college, careers, and as productive, contributing members of society, students in the 21st century must become proficient users of digital tools. School technology plans focus on student access to technology. Although our students have access to rich technology tools during the school day, the students may not be using the technology optimally to build their digital skills. All students may not have access to digital technology during and after school to build and sustain their digital practice.

Vygotsky’s work emphasized students transferring their learning into society by hands-on use of tools to solve problems (Miller, 2002). Digital technologies provide a means for achieving the goals of curriculum and instruction and the building of digital skills required for today’s workforce. Students who lack the technology experience to build technology competence do not have the opportunity to build their digital skill level as their technology-enriched peers do.

Significance

Although students may not have computers and printers at home, teachers assign projects that require the use of these tools. As an educator, I would not consider handing out textbooks to only a limited number of students to use outside of class, yet students who do not have computers to use after school lack a valuable learning tool. Without the availability of digital tools, some students are at an educational disadvantage outside of the school day. If this problem of practice is not resolved in the near future, there are
potential risks for students. When all students do not have the same opportunities for learning, preparation of a competitive, highly trained workforce is jeopardized. Twenty-first century skills that are so vital to our students’ future success are not available to students without access to digital technology outside of school.

Digital learning continues to evolve in education across the United States (Bellanca & Brandt, 2010). The issue of all students having access to opportunities for powerful digital learning inside and outside of the classroom is significant for different educational stakeholders, including teachers, students, parents, school boards, and administrators, along with the curriculum and technology departments (Surdin, 2009). Full student access to digital learning tools involves a change in student learning and teacher practice (Rothman, 2006). Just as the integration of computers into teaching and learning presents unforeseen challenges for implementing effective lesson planning, obstacles may arise with digital access outside the school. Successful integration of digital access for all students requires adequate preparation from all stakeholders. Research on effective use of digital tools to enhance learning inside and outside of school will provide information to improve educational practice (Borja, 2008).

The school I work in offers students the opportunity to choose from a variety of online electives through the Virtual High Schools program. While serving as the site coordinator for this program, I have found that students without Internet-accessible computers at home are at a disadvantage and experience difficulty in meeting the course requirements of online classes. The students become discouraged when they fall behind in their coursework and request to drop the courses. Additionally, students with access to
the tools may not have the basic digital skills for success. One of our students withdrew from her online class because she did not know how to create a wiki and upload photos.

**Discussion of Practical and Intellectual Goals**

The practical goal of my research was to document powerful learning by asking the students to provide information about their experience of use of technology inside and outside of school. The intellectual goal of my research was to use new information discovered about digital experience to inform teaching and learning practice to build students’ digital competence. The intellectual goal sought to empower marginalized students by provoking change in instructional practice.

**Research Question and Goals**

The study addressed a single research question: *In what ways have students experienced the use of technology tools for engaging in powerful learning experiences during the school day and outside of school?* Through qualitative inquiry, I sought to gain a greater understanding of the students’ unique perceptions. In semistructured interviews, five students shared detailed descriptions of their perspective about technology use and how they interpreted their experiences with technology. I was a critical listener during the research process, allowing students to have a voice (Yin, 2009). The information from the interviews was used to develop questions for two focus group sessions involving 11 additional students (Patton & Patton, 2002). These data gathering methods were used to address the problem of practice of the digital divide, defined as students without access to technology (Banister & Fischer, 2010) and the impact of this lack of access on social equity in teaching and learning situations. The
digital divide exists for students who cannot access at home the same software and tools they use in school (Fitch, 2006) and is influenced by interrelationships among students, teachers, parents, and information technology.

**Theoretical Framework**

The theoretical framework for investigation of this problem of practice included critical learning theory and online theory. Critical theory provided a lens for looking more closely into the gap in technology tools available to some children and the causes and effects of this issue. This theory informed my problem of practice through further investigation of the impact of the lack of technology tools available for learning outside of the school day (Gallos, 2008). Online theory focused the research on the problem and its effects on student learning and teacher methodology. Using online theory as a lens to investigate this problem of practice provided me with strategies to understand this problem better and gather information about integrating digital technologies into learning.

**Critical theory.** The inequity of access to technology for some students can be more closely investigated using critical theory as a lens. Critical theory provides a means to examine how technologically deprived students experience the social impact of power and privilege (Darder & Torres, 2003). A study by Warschauer, Knobel, and Stone (2004) on the digital divide among students in California showed that students with a low socioeconomic status experience the greatest technological disadvantage. Critical theory is also related to the reasoning behind the No Child Left Behind (NCLB) Act (2003), which was designed to end “the deeply rooted inequality and injustice” in public education (Skrla, Scheurich, & Nolly, 2004, p. 133). Graduation rates demonstrate that
some at-risk students may not have the opportunity to graduate from high school due to their race, socioeconomic status, or other factors (Fairlie, Beltran, & Das, 2010). Policy makers must comply with NCLB requirements by developing programs for student educational success (NCLB, 2003).

Critical theory was developed through the influence of Herbert Marcuse as a result of his work at the Frankfurt School (Kincheloe, 2004). Along with Paulo Freire, Marcuse was influenced by the suffering after World War I, which focused critical theory on people’s experience of enduring distress. The theory seeks to understand the influence of what is perceived and not perceived about the world and how to nurture human potential to make personal and social change. This is the main focus of critical pedagogy. Freire taught that pedagogy is concerned with changing the world as much as encouraging the development of synthesis of ideas. Educational philosophers such as Friere stressed the direct connection between social order and the education of youth to become both knowledgeable and skillful, which was thought to be influenced by teachers promoting students’ higher-level thinking and setting the example of being a scholar.

Critical theory can be used to uncover inequities in power and remove its influence in education. If knowledge is power, students who do not have access to technology to gain skills and knowledge are at a disadvantage. Efforts to uncover evidence of inequality connected to student access to technological tools, to reveal ways students are empowered through technology access, and to determine how students may be disempowered can provide critical information for this problem of practice (Creswell, 2009).
Online theory. Online theory is a relatively new theory influenced in part by the work of Lev Vygotsky (Miller, 2002). This theory, which includes connectivism theory, reveals the advantages of digital learning with the availability of Web-based activities (Anderson, 2008). Using the resources of the Internet, learners collaborate online and increase their knowledge, with the result being the construction of individual value and educational growth (Anderson & Elloumi, 2004; Miller, 2002).

Theorists such as Vygotsky provided the foundation adopted by online theorists Anderson and Ally in developing the theoretical knowledge for further investigation into a resolution for this problem of practice. Vygotsky’s theory, promoting student learning from peers to develop new information or “social cognition” (Anderson, 2008, p. 39), supports the online learning opportunities now available 24/7 with digital technology. The importance of social connections was stressed in Vygotsky’s concept of communities of practice, where the interrelationship of culture and social connections impacted learning (Boitshwarelo, 2011).

Online theory is focused on the requirements of the 21st-century worker to be highly skilled in information literacy and digital tools (Anderson & Elloumi, 2004). The workplace of today is undergoing constant change. As the workplace evolves into a setting that supports a global information society, teaching and learning have to change to meet these requirements. Vygotsky approached the need to develop new skills with his zone of proximal development (ZPD), or the skill level of the child compared to his or her potential with the assistance of a more knowledge other (Anderson & Elloumi, 2004). This concept is useful in examining the potential for knowledge and skill building with online learning.
Online theory provided a lens to examine whether or not students who are without computers and lack ICT skills will raise their skill levels with increased instructional technology experience. Socioculturalists, such as Vygotsky, view the specific culture that the child lives in to determine the specific knowledge and skills needed. This information is used to decide which tools, such as technology, will provide the experience needed to build the skills needed. Online theory is the first theory that allows us to view the educational benefits of the Internet with the capabilities now available for communication and research (Anderson & Elloumi, 2004).

One characteristic of online learning is the community of participants available to collaborate (Anderson & Elloumi, 2004). Vygotsky’s teaching about social cognition aligns with this feature of online learning (Anderson & Elloumi, 2004). Students work together online and, in doing so, create new knowledge. Connectivism learning theory is a type of online theory—discussed in Terry Anderson’s (2008) book, The Theory and Practice of Online Learning—focusing on the learner and his or her environment online while using the computer as a tool for accessing knowledge (Boitshwarelo, 2011). Connectivism has five main features that influence learning:

1. Learners mutually benefit by connecting with a learning community and giving and receiving information from others with compatible interests.
2. The nodes involved in a network are expansive, supporting the building of knowledge in innovative, self-directed, diverse ways.
3. Information is available from different sources that give a variety of perspectives with the accessible network connections.
4. With continuous updates to information, it is necessary to validate facts.
5. The diverse connections provide the foundation for designing diverse learning outcomes (Boitshwarelo, 2011).

Integrating Vygotsky’s theory with the online resources available today provides a lens to discover the links for building digital literacy skills in students. Just as Vygotsky stated that there is a current level of knowledge the learner has that can be built on by observation and communication with a more knowledgeable other, the online educator also possesses this potential to increase knowledge in his or her students (Anderson & Elloumi, 2004; Miller, 2002). The successful integration of information technology into instruction will involve vast changes in teaching practice.

**Organization of This Dissertation**

Based on this theoretical framework, Chapter II reviews the literature relating to the problem of student access to technology in three general areas: digital textbooks, student access to learning tools, and supplemental access to technology. Digital textbooks are technological tools used to support teaching and learning objectives. The literature was reviewed to uncover the advantages and disadvantages of digital textbooks using online theory as a lens. Student access to learning tools may impact their achievement. Critical theory provided a lens for discussing the possible impact when students do not have learning tools available to them. In an attempt to lessen the digital divide, supplemental access to technology is provided for those lacking access. To determine if supplemental access to technology provides power and emancipation for those students most in need, both online theory and critical theory were used as a lens for reviewing the literature for that area.
Following the literature review, Chapter III outlines the research design for this qualitative study designed to discover the student voice about powerful learning experiences using technology. Chapter IV discusses the results of this study, and Chapter V discusses the major findings and conclusions.
Chapter II:

Literature Review

In a society rich with communication tools, strong information and communication technology (ICT) literacy skills (Anderson, 2009) will prepare students for success in the future. With the continued implementation of technology tools to enhance education, there remains a gap in the availability of computer technology for all students outside of the school day. The issue of students without equal access to technology, or the computer haves and have-nots, has been termed the digital divide (Banister & Fischer, 2010). As we introduce more and more technological tools, such as digital textbooks, into K-12 education, the question is whether or not this new form of teaching and learning will end the digital divide. This chapter investigates the problem of practice related to student access to technology outside of the school day, addressing three main questions:

1. What does existing scholarship reveal about the effectiveness of digital textbooks in providing equal technological access for every student?

2. What does the literature reveal about student access to learning tools or materials?

3. What does the literature reveal about the relative effectiveness of programs that provide supplementary access to technological tools for students?

The first question was informed by online connectivism theory in seeking to discover how the use of digital textbooks impacts student access to technological tools and resources outside the school day. The second question was informed by online theory and critical theory, as I sought to examine literature pertinent to my problem of practice as it related to student access to learning tools. The third question was posed to examine
other substantial change efforts relating to technology that were implemented successfully using critical theory as a lens.

**Digital Textbooks**

An initial review of scholarly writing about digital learning revealed that the introduction of digital textbooks in colleges and the K-12 educational community enhanced learning opportunities (Lau, 2008). More in-depth information about this transition in learning was revealed by reviewing initiatives in digital textbook implementation throughout the world and from institutions of higher learning in the United States. Student and teacher reactions to digital textbook initiatives were examined as part of the literature review (Nakos & Deis, 2003).

Maynard and Cheyne (2005) studied 60 11- to 12-year-olds, half using digital textbooks and half using printed textbooks. They found that the students preferred digital textbooks and that those using digital textbooks had higher test scores than those using printed textbooks. They questioned whether the favorable responses were related to the students’ excitement about using a new tool or to the increased attention they received during the experience. Vernon (2006) studied the reaction to digital textbooks by 23 students in a social work program and had a very different finding: 70% of the students responded negatively to their use. These results led to a follow-up question about why students disliked the digital textbooks. Yet it is difficult to agree with the results of that study, that digital texts are bad, without more evidence. Students are digital natives, and the digital textbook allows them to use an electronic tool for reading that connects with their daily experience outside of school where they consistently use technology.
A later study conducted to prepare for the integration of digital textbooks into the education system in Korea revealed positive results. Jung and Lim (2009) found that electronic texts positively influenced academic achievement. The students from low-income households showed marked improvement in academic achievement while using digital texts. The results of this study support the integration of digital texts to lessen the digital divide (Jung & Lim, 2009).

Digital books can be accessed in different ways. Some are accessed over the Internet; others are available in CD-ROM format, and a computer is needed to view the text. Book reader devices, such as the Kindle or Sony book reader, include Internet access to download digital texts (Lau, 2008). School laptop and iPad initiatives have been introduced for digital text storage and include most of the software and online access desktop computers have. If schools do not provide students with home computers and digital texts are available online, the students need to have a computer at home to complete assignments. Students without home computers will have to find other ways to complete assignments, such as using public libraries with Internet access. Although electronic book reading devices have Internet access, the access is limited. Some tools available with digital texts enhance the reading experience. Students can highlight text for future reference and take notes with digital texts (Larson, 2009). Digital textbooks include interactivity not possible with traditional texts. The digital texts have the option of video and sound for multimedia viewing of content (Jung & Lim, 2009). The additional costs of implementing digital texts have to be considered for school districts with limited funding. Laptop initiatives or the purchase of book reading devices and
licensing fees for digital texts, along with training for staff, students, and parents, will impact school budgets when digital texts are implemented.

Having access to digital tools without formal instruction on communications skills will not necessarily improve student digital competence. Students still need to build competence in evaluating information found online for validity. The lack of competence in this area appears in the world of work, when younger staff members do not take the time to validate information found on the web. Knowledge and information officials at the firm Swiss Re instituted a training program for workers to learn how to examine information found online for credibility and trained staff to be cautious about using free information (Rainie, 2006). Building information management skills is necessary during the school years so that students can gain a high level of expertise before graduation and be successful in college and careers.

I reviewed research about digital textbooks to attempt to link digital textbook use with making technology more readily available to students outside of school. It was proposed that digital textbooks could reduce the digital divide. The research revealed that the digital divide exists during the school day as well as outside of school. There is little control over how students use computers outside of school. During the school day, teaching and learning practices provide the optimal setting for integrating technology into the curriculum for building students’ digital skills. This leads to the second question for the literature pertaining to access to digital tools.

**Student Access to Learning Tools**

This section addresses the second question, “What does the literature reveal about student access to learning tools or materials?” In addressing this question, it is important
to consider the variety of technology tools now available. Students have access to a wide variety of electronic tools and communication technology outside of school. The digital tools include such devices as desktop and laptop computers, iPads, tablets, cell phones, digital cameras, video cameras, DVD burners, MP3 players, and iPods. Among the communication technologies available with Web 2.0 are email, instant messaging, personal web space for social networking (MySpace, Facebook), blogs, Wikis, and online interactive video games (Greenhow, Robelia, & Hughes, 2009). Students participate in online collaboration with social networking to exchange information in their personal lives all the time (Bellanca & Brandt, 2010), and they continuously use technology tools, such as cell phones, outside of school (Bellanca & Brandt, 2010; Levinson, 2013).

According to Waycott, Bennett, Kennedy, Dalgarno, and Gray (2010), students expect technology to be incorporated into their learning.

Advantages of technology use in classrooms. A study by PBS Learning Media found that 74% of teachers agreed that using technology tools in education helps to “motivate” students to learn (Hanover Research, 2013, p. 8). The students are motivated to learn when they are allowed to design their own projects (Pink, 2009). The technology tools available now provide students with opportunities for designing projects that are interesting to them and may encourage students to learn. A 21st-century skill, “self-directed learning,” is possible with the resources, or tools, available on the Internet (Bellanca & Brandt, 2010, chap. 5, para. 1). School officials in Singapore recognized the high level of technological skill students possess today. Their vision fosters students’ learning without being “taught” by using technology as a learning tool (Bellanca & Brandt, 2010, chap. 5, para. 5).
A qualitative study about the digital divide in an urban middle school by Banister and Fischer (2010) provided data about the impact of technology on students and student access to technology. Even though the study revealed reductions in the digital divide, it also revealed that a lack of access to technology prevented some students from building critical ICT skills.

**Pedagogy and student ICT skills.** Generally, the studies revealed that the combination of instructor pedagogy and technological competence influences the building of student ICT skills. In terms of pedagogy, the integration of technology tools in the classroom is greatly enhanced when instructors use constructivist teaching methods, in which the teacher allows students to construct their own knowledge. The teacher focuses student attention on identifying what they already know about the subject, and then asks the students to do research on the subject to discover new information. The students then discuss their discoveries with peers to problem solve, leading to the development of new knowledge (Solomon & Schrum, 2007). ICT competencies are strengthened by having the students use technology tools for applying their knowledge and building their skills (Anderson, 2009). If computers are used for drill and practice or unrelated tasks, this will not provide the experience students need to build their skills in higher-level problem solving (Rentie, 2008). While constructivism makes it possible for students to build ICT literacies and to apply this learning in their daily lives, teachers may not be confident with constructivist teaching and learning methods.

Building competence in using technology tools includes using a variety of technology tools. Teachers may need more planning time to develop lessons based on implementing technological tools (Banister & Fischer, 2010). An initial review of the
literature on the use of digital learning tools revealed a need to change teaching practices to align with the use of digital tools (Kopyc, 2006). Although digital tools have been continually promoted for increasing learning opportunities, not all educators are changing their teaching practices to align with the use of digital tools. This factor also relates to the online textbooks discussed in the preceding section, since teacher pedagogy and technology competence have an impact on the use of online textbooks (Burniske, 2008). In Vernon’s (2006) finding that 70% of students in a master’s of social work program disliked digital texts, more information about teacher pedagogy and technology competence would provide a clearer perspective about the students’ experience. An article by Sharon Kopyc (2006), “Enhancing Teaching with Technology: Are We There Yet?” cited the low number of instructors who actually use technology effectively to enhance teaching. In addition, adequate technical support for teachers and students is a factor (Warschauer, 2003).

It is not only important to provide the technology; it is just as important to measure whether or not the intervention is leading to educational gains. With a focus on improving access to ensure that students are properly prepared to use digital tools in our information society, measurement of student ICT skill levels, showing gain or regression after continued use, will provide useful data (Burniske, 2008).

**Teacher professional development.** The importance of teacher professional development was evident in the research about digital tools. The digital natives, or those students who have grown up with technology, are much more comfortable and natural at using technology as a resourceful tool. Conversely, teachers may lack the skills to incorporate technology into the lessons. Preparing teachers to use technology effectively
is an important consideration when integrating technology tools into the curriculum. To identify data about transitions to digital tool use in the classroom, examples of professional learning communities (PLCs) were sought during this literature review. The discussion about this research follows.

A preliminary examination about PLCs revealed success stories about schools adopting this structure and the resulting increase in student achievement (DuFour, DuFour, & Eaker, 2008). Learning communities are designed for instructors to share best practices and strive to continually improve curriculum and instruction so that all students have the opportunity to succeed. In providing educators with a supportive environment to learn from their peers and build on existing skills while developing new skills, the PLC model serves as a structure for supporting teachers in changing educational practice.

Little data were found to connect PLCs directly with the use of new educational technology tools (DuFour et al., 2008). One example found was in Singapore (Bellanca & Brandt, 2010), where PLCs are used to support education change, including technology integration. One of the learning themes connected with PLCs in Singapore was to teach less and to promote students’ independent learning. This practice allows teachers more time to develop new instructional materials. This is a change in classroom culture from the teacher as all-knowing to the teacher as the facilitator and learning coach, giving students learning direction with leading questions. With all the online resources available to students, independent learning occurs both inside and outside of school. A study by Katyal and Evers (2004) reported that students’ “autonomous self-learning that takes place outside of school was seen as being more authentic to the lives of students”
Additionally, students learn independently without being told to do so (Laxman, 2010).

The scant data on PLCs with a direct focus on the use of technological tools in the classroom identifies an area for future study. With the integration of technology tools into the classroom, teachers require professional development to build their personal skills. Regardless of the level of technological competence teachers have, generally they have been reluctant to share their technology expertise with other teachers (Fazioli, 2010). This absence of sharing among teachers prevents teachers from changing everyday teaching practices to align with the information age. Although peer mentoring of teachers is an advantageous way to share best practices and provide cost-effective professional development for staff, modeling of best practices using technology in the classroom is not a typical occurrence in schools. For digital tool integration into teaching and learning, it is important to consider the leadership role.

**Leadership in educational change.** When any type of change is implemented, there will always be resistors. The information society we now live in changes rapidly. Staff and students need school leadership to support change for minimal impact on school climate and maximum benefit to students and staff. Implementation of digital tools into the curriculum has evolved slowly compared to industry use of these tools. A study by Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) found that administrators are encouraging teachers to promote students’ use of online learning, or “self-directed learning,” to supplement classroom instruction (p. 433). Transformational leadership has the potential to drive this change successfully. The concept of PLCs coincides with the leadership theory promoted by Fullan (2008). According to Fullan,
when leaders support specific communication among staff and provide guidance and help when requested, efficiency increases. The efficiency is evident when teacher camaraderie is encouraged and individual staff members are allowed to focus on sharing their personal areas of expertise with others. PLCs help to organize the communication among staff for a specific result, encouraging teachers to improve their skills to benefit their individual classrooms and the school community (DuFour et al., 2008). Allowing staff the freedom to produce the outcomes desired in promoting integration of technology into the curriculum by learning from each other in PLCs necessitates a leadership perspective that responds appropriately when things go off course and that strongly supports effective accomplishments.

**Summary.** A review of the literature was conducted to identify possible frameworks used for assessing whether or not learning has taken place with the introduction of new learning tools (Fullan, 2008). The availability of digital tools is not the answer to reducing the digital divide. Students are found to lack the basic skills needed to utilize the technology effectively. Measuring student skill levels will reveal the gaps in learning that need to be addressed for raising technological literacy. Providing teachers with training to build their skill level in delivering instruction that fully integrates technology into the curriculum will provide students with learning experiences to build their skills. Although PLCs provide teachers with a supportive environment for integrating new methodologies, the literature review did not reveal examples of PLCs specifically implemented for technology integration. The discussion about the availability of digital tools leads to the third question about supplementary access to technology.
Supplemental Access to Technology

The third question for the literature review, “What does the literature reveal about the relative effectiveness of programs that provide supplementary access to technological tools for students?” is explored in this section. Supplemental access is provided in various ways, including community technology centers and programs to provide student access to home computers.

Community technology centers. The research demonstrated that structured environments where students learn how to use technology effectively, such as community technology centers, were valuable for building student technology competencies. London, Pastor, Servon, Rosner, and Wallace (2010) discussed how community technology centers focus on the development of workplace skills and bridging the digital divide. The technology centers provide structure to improve student skill levels in preparation for the 21st-century workforce, which requires technological competence to meet the demands of our knowledge economy. The studies did not detail specific measures for assessing ICT competencies. Future studies about student technology strengths and weaknesses would help support school improvement efforts to improve student ICT literacy. For example, following participants of community technology centers in a longitudinal study to see how they fare later in life with the head start they received would provide data about the potential for future success with such interventions.

Home computers. Student access to home computers was investigated as a form of supplemental access to technology. Various studies focused on the topic of technology inequities. Zhao et al.’s (2010) qualitative study focused on Internet inequality and how it related to the variables of student Internet use and academic achievement. Their first
The second question addressed the relationship between student access to the Internet and academic performance. The findings revealed that online access, without formal training on search techniques and research methods, would not help to improve Internet self-efficacy. For example, Britannica Online is ranked as number 5,128 of the most trafficked sites on the Internet (Rosen, Carrier, & Cheever, 2010). Instead of using Britannica, students prefer Google and use the first few links that are generated when conducting research. Wikis, rated as the 17th most trafficked sites on the Internet, are overused as a reference, and they do not have any peer review or authentication to validate the information posted.

A quantitative study about equity in access to computers examined the correlation between home computers and high school graduation rates (Fairlie et al., 2010; Metiri Group, 2009). The results showed that students with home computers were 6% to 8% more likely to graduate from high school than those without computers at home. These data support the need for students to have computers outside of school. More data is needed about the other influences in the home, besides computers, that may contribute to increased graduation rates.

Students who have computers at home are not necessarily using computers to build their ICT skills. In addition, providing students with supplemental access to technology to build their skills is not measurable with student home computers (Zhao, Lu, Huang, & Wang, 2010). Students still benefit from the guidance of educators for building digital skills and increasing their knowledge about ethical use, and one
component of ICT skill building is basic knowledge to use the computer effectively as a tool.

**Summary.** Providing supplemental access to technology was found to benefit students when activities were organized to teach students specific skills to improve their competence in using technology effectively. Student home computer use cannot be monitored for optimal learning experiences and the development of digital skills. Providing students with supplemental access to technology after school with structured learning experiences allows students the potential to build their digital skills.

**Findings and Future Study**

The literature review revealed that a digital divide still exists for low-income students concerning access to technology tools after school hours (Neuman & Celano, 2006). As society changes and becomes more and more dependent on digital literacy skills for employment success, these disadvantaged students are increasingly impacted in a negative way. As a result of this literature review, the problem of practice of student access to technology evolved into many interconnected issues. Research on the broad question of whether or not digital textbooks will provide computer equity for all students shed light on other areas that influence computer equity. Ensuring that computers are accessible to all students is only the beginning of the solution. Teaching methods, learning strategies, computer use, and teachers’ access to training and technical support impact this problem of practice. Some teaching methods may not provide adequate experience for students to develop digital skills.

The research revealed that, at the individual classroom level, teacher pedagogy and technological expertise influence the use of technology for teaching and learning.
The information from this review revealed the possibility of changing the issue of computer equity for all students in a positive way during the school day. The problem of practice changed from an issue of home computer availability to the potential for designing technology learning experiences during the school day to reduce the digital divide. How students and teachers use computers during the school day might influence student skill development, and schools can do more to provide students with the basic skills they need to build their level of technology competence. One of many deficiencies cited for student researchers was their lack of ability to evaluate information critically.

Based on the literature review, the problem of practice is much more complex than the lack of computers in some students’ homes. While it is true that some students do not have computers at home, even those who do have a home computer may not use it to practice digital skills, build computer and information technology literacy, or prepare for future postsecondary education and employment. Educators cannot control the use of computers outside of school but can make a difference within the school.

The bodies of literature revealed areas for future study. More information is needed on how technology is actually being used in the classroom. Studies to determine the skills required for technological competence in an information society are needed, and research is needed on ways to change outdated classroom practices to integrate technology fully into teaching and learning. Finally, future study is needed to determine other influences, such as teacher pedagogy or technology competence, that impact student experience with digital learning. The next chapter discusses the methodology of the current qualitative study, which addressed how students experience the use of
technology tools to engage in powerful learning experiences during the school day and outside of school.
Chapter III:
Research Design

I conducted a study to examine the problem of practice of student use of technology for powerful learning to build their digital skills. The study addressed one research question: *In what ways have students experienced the use of technology tools to engage in powerful learning experiences during the school day and outside of school?*

This chapter discusses the research design, explaining the rationale for the qualitative approach and the focus on the student perspective. The chapter then discusses site and participant selection, procedures for data collection and analysis, attempts to ensure the study’s validity, and the protection of human subjects.

Research Design

**Qualitative approach.** A qualitative research design was chosen, as it aligns well with the investigation of this problem of practice. In qualitative research, the researcher uses tools to interpret data about the topic of study (Stake, 2010). The researcher gathers the interpretations from the people experiencing the situation. The participants in the study communicate their perspectives about their experience. The researcher seeks to obtain as many details about the situation as possible. Researchers use qualitative methods to conduct ongoing discovery about particular situations, and the main research instrument is the researcher (Merriam, 2009). The researcher is strategic in this process and determines the data collection techniques used based on the topic under investigation. Through the process of conducting qualitative research, the researcher makes conclusions about the subject. Qualitative study allows marginalized groups to gain a voice by
providing information from their perspectives about the phenomenon under study
(Merriam, 2009).

Researchers conduct qualitative research to try to understand the meaning of the
participants’ experience. The investigative process allows the researcher to get different
responses from each participant, allowing for rich and diverse data collection. The
researcher is then able to interpret the data with the possibility of uncovering unique
information about the topic of study (Stake, 2010). Qualitative research allows us to try to
make conditions better, to learn something new, and to gain a clearer perspective
(Merriam, 2009). In a qualitative study, researchers construct meaning from the details
uncovered about a subject.

I used semistructured, reflective interviews and focus group qualitative data
gathering methods for this investigation of the problem of practice. The phenomenon of
student technology use in the context of these settings was suitable to interview- and
focus group-based research to uncover different perceptions from the individual students
(Creswell, 2009). Research supports the use of focus groups for data gathering to evoke
honest, open feedback from participants (Kitzinger, 1995; Stefl-Mabry, Radlick, &
Doane, 2010). By investigating the student perspectives in the context of technology use,
I deeply explored the background information about the students’ experiences of the
phenomenon. I used the information derived from the interviews to prepare how and why
questions to pose to the students during the focus group sessions. My goal was to gather a
range of perspectives using interviews and focus groups (Merriam, 2009).

The different data sets collected using these methods allow for triangulation, a
strategy that supports a study’s validity (Merriam, 2009). During the data gathering
process, I was skeptical about my understanding to make sure I was not forcing my own bias onto the students. As the researcher, I documented and continually reassessed as much data as possible about the subject (Stake, 2010).

The insights gained from this interview- and focus group-based qualitative study are applicable, or transferable, to other similar educational settings (Patton & Patton, 2002). This qualitative study provides clues about students’ technology experience and in doing so provides insight about best practices for building digital skills through powerful learning experiences. The interview and focus group study methods allow the researcher to inquire about what is actually happening (Yin, 2009). The purpose of this study was to illustrate the topic of evaluating technology use for developing skills (Yin, 2009). This search for detailed information addresses a descriptive question about a naturally existing circumstance in its actual environment. The information derived helps to explain what is happening and how and why this is happening. Descriptive questioning helps us learn as much detail as possible about a phenomenon (Yin, 2012).

**Student voice.** I chose the student voice for data gathering in this study for a variety of reasons. For the first time in history, we have students who have never been without technology in their lives. Most instructors do not share this experience. The student voice is critical for this study to find out how students are using technology for powerful learning.

A wealth of research is available about student voice and its benefits for school improvement. Rudduck and Flutter (2004), in their book, *How to Improve Your School: Giving Pupils a Voice*, pointed out how instructors’ and school officials’ impression of students influences the ability to make positive change in teaching and learning. The
authors stressed that, by hearing the student perspective, there is the potential for students to communicate valuable information about their learning (Rudduck & Flutter, 2004).

A study related to this investigation supports using the student voice to gather information in support of changing teaching and learning practices. This study, “Can You Hear Me Now? Student Voice: High School and Middle School Students’ Perceptions of Teachers, ICT and Learning” (Stefl-Mabry, Radlick, & Doane, 2010) addressed information and communication technology use and student voice. The study discussed changing the way teachers interact with students by acknowledging student feedback about their educational experience (Stefl-Mabry et al., 2010). It is not a common practice for teachers to seek information from students about what they need help with to become successful in school. Uncovering how students learn by using technology identifies suggestions for creative teaching and learning practices. Providing the opportunity for students to comment demonstrates that the questioner respects their contributions and paves the way to building rapport with students (Kitzinger, 1995; Stefl-Mabry et al., 2010).

A positive teacher-student relationship provides a comfort level where students will easily offer their input (Fielding, 2007). In a review of the work of Jean Rudduck, a well-known researcher promoting student voice, Michael Fielding expressed the value of educators reflecting on the expected outcome of student input. Fielding cautioned that educators must understand the limitations and advantages of this method of information gathering. One limitation is the role of the teacher as the authority figure having the ultimate control. Listening to the student voice establishes more of a community atmosphere in the school. Basil Bernstein eloquently described the student voice as “the
cultural larynx of the school” (as cited in Fielding, 2007, p. 333). Given the research supporting the positive benefits of student voice in educational change, this study attempted to allow students the freedom to express their opinions during the interviews and focus groups.

In bringing out the student voice to gain useful information, it is important to allow students to critically reflect on learning and express their opinions. The key here was to make students comfortable about expressing themselves to someone considered an authority figure without fear of retribution for disagreeing or criticizing. To uncover ways to improve education, the authority figure must be comfortable hearing criticism about school practices. My aim was for students to want to participate in this study and freely express their opinions. As the researcher, I impressed upon the students the value of their contributions and, most importantly, I let the students know that I intended to use their contributions in a positive way for altering educational practices (Rodriguez & Brown, 2009).

Site and Participants

Site. The site for this study was a public regional vocational-technical high school located in a suburban area of Massachusetts, with students commuting from eight district towns. The school’s enrollment of 700 included students in grades 9 through 12 and postgraduates aged 18 to 24 years. The school offered 18 different technical programs: automotive, auto body refinishing, banking/marketing, carpentry, cosmetology, culinary arts, dental assisting, design and visual communications (DV), early childhood education, electronics, electrical, engineering technology, health assisting, hotel and restaurant management, machine tool technology, plumbing, programming and web development,
and TV media/theater arts (TVM). The students received high school diplomas and technical program certificates upon graduation. Over 60% of the students entered college after graduation. The focus of the school was to train students for success in college and their chosen career pathway. In grades 9 through 12, each technical program had an average of 10 students at each grade level.

**Site access and contextual knowledge.** The leader of the school was the superintendent for the district, who occupied an office on the school grounds and actively participated in the overall, day-to-day school management. The superintendent approved the research project (see Appendix C).

I have worked in this vocational-technical school for the past 20 years, first as a computer technology instructor and during this study as the director of technology. My experience provided me with contextual knowledge and experience of the site. As part of my job, I was responsible for overseeing the curriculum and instruction for the technical programs I supervised and all of the instructional technology for the school. I directly supervised one of the programs for this study, DV, and I supervised the other program, TVM, in the past. Through the process of supervision and evaluation of the technical instructors and as the technology leader for the school, I developed a relationship with the students in a nonteaching support role. The positive relationship I had with both the students and staff enhanced the data-gathering process for this study.

**Participants.** Participants were purposely selected from senior students in two technical programs, DV and TVM (Creswell, 2007). One reason these two programs were chosen was the enrollment of over 10 seniors in each program for the fall of 2012. This number provided enough students for some to opt out of the study. Also, these
groups of students were very verbal about their technology experiences. The willingness of the students to share their opinions, evidenced by my experience, helped with the information-gathering process.

The TVM students are studying to become broadcasters or work in the theater. The DV students are training to become graphic designers. The participants study their technical program curriculum in areas designed to mirror an industry environment: the DV program area is a large space with multiple computers and copy center equipment, and the TVM program includes a classroom, computer lab, broadcast control room, and fully equipped television studio. The students in these programs use computer technology to meet the curriculum requirements of the Massachusetts Department of Elementary and Secondary Education Vocational-Technical Education Frameworks (2012). Students enrolled in the TVM program use Apple Final Cut Pro (Version 7, 2009) and Avid Media Composer software (Version 5, 2010) to edit their video productions. DV students use the Adobe Creative Suite 6 (Version 6, 2012) (CS6) software collection to create graphic design projects.

The research question focused on students and their experience building their digital skills using technology for powerful learning experiences. The students had experiential knowledge of the research question (Creswell, 2007), since they worked with technology extensively in their technical programs. As a token of my appreciation for the students participating in the study, each student received a $15.00 Amazon gift certificate. This gesture rewarded the students by compensating them for their contributions.
Participant recruitment. When I informed the students about the project, I told them I would choose students randomly for individual interviews and focus group discussions from the group of students who volunteered for the study. Five males and 11 females volunteered to participate in the study. With a smaller number of males than females, I considered the number of students by gender when selecting students for the interviews and focus groups. I decided to include three females and two males in the interviews. Once the students returned all the permission slips, I separated the student names by male and female for a drawing. I invited the students from the two technical programs to the library to witness the drawing. One of the students in the TVM program who was not participating in the project randomly chose two male names and three female names for the interviews. The remaining students participated in the two focus groups.

Data Collection

The focus of the data-gathering process for this study was on student perspectives about the use of technology for building digital skills by experiencing powerful learning. The data sources for this study included semistructured, reflective interviews and two focus group-based discussions (Yin, 2009).

Interviews. The data collection process began with the interview sessions. Over a 1-week period, I interviewed five students individually for 45 minutes each. Interviews were audiotaped and transcribed immediately, with student names replaced with the pseudonyms Steven, Nancy, Ted, Mary, and Carmella. Interviews were held in a quiet teacher library, which has a window and comfortable chairs around a large conference table. Students attended alternating weeks of technical and academic classes, and
interviews and focus group sessions were held during the scheduled technical program week.

I conducted semistructured, reflective interviews using five open-ended questions to document student descriptions of their experiences with technology (Roulston, 2010). The questions were as follows:

1. What does a powerful learning experience using technology mean for you?
2. Describe any experiences you had in using technology tools (phone, software, Internet, email, blog, wiki, Facebook, etc.) for powerful learning experience(s) in school and/or outside of school.
3. If given the opportunity to use technology for powerful learning projects for school, what software, equipment, and access would you want to use?
4. What do you think may encourage students to use technology for powerful learning experiences?
5. What do you think may discourage students from using technology tools for powerful learning experiences?

At the beginning of each interview, as shown in the interview protocol (Appendix A), I discussed the meaning of powerful learning with the students and asked them to describe powerful learning to confirm their understanding. Rivera and Rowland (2008) characterized powerful learning as learning that is meaningful with special qualities that make it valuable. Some of the qualities include being practical, engaging, authentic, challenging, high quality, and widely applicable. An influential mentor may be involved in powerful learning experiences. For both the interview and focus group sessions, I
displayed a poster based on Table 1 to inform students about the meaning of powerful learning.

Table 1

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term from research</th>
<th>Term for students</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Practical</td>
<td>Useful</td>
</tr>
<tr>
<td>E</td>
<td>Engaging</td>
<td>Keeps you interested</td>
</tr>
<tr>
<td>A</td>
<td>Authentic</td>
<td>Real</td>
</tr>
<tr>
<td>C</td>
<td>Challenging</td>
<td>Not boring</td>
</tr>
<tr>
<td>H</td>
<td>High quality</td>
<td>Valuable</td>
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</tbody>
</table>

Once I determined that the students understood the meaning of powerful learning, I began asking the interview questions. When appropriate, I asked the participants more probing questions to evoke more detail about their experiences. I encouraged participants to ask questions throughout the interviews if they needed clarification, and I let them know that they could ask me to repeat or explain a question if necessary.

Focus groups. Two focus group sessions were held involving 11 students, with five students in the first group and six students in the second group. One of the focus groups was held in the teacher library, and the other was held in a TVM classroom, which is a quiet, out-of-the-way room with student desks.

The focus group discussions began with a description of the characteristics of powerful learning (which, again, were displayed on a poster in the room). Once I was confident the students understood powerful learning, I conducted the focus group discussion. I posed six questions based on the responses gleaned from the interviews:

1. What type of technology is available or is not available for powerful learning at school and outside of school?
2. Describe the technology tools you use to collaborate with others for powerful learning.

3. Describe how you find information online to answer questions. Give examples of any roadblocks and explain how you could eliminate the roadblocks.

4. Imagine I am an alien life form. I just landed here and I do not know how to learn things. I need your help to learn in a powerful way by using technology. Describe an enjoyable, fun project where you learned a lot because you used technology, or describe a time when you were using technology while trying to learn something hard or challenging.

5. Thinking about using technology for powerful learning, what would you like to learn or teach others?

6. Give examples of times you learned new ways to use technology from others (who?) or taught teachers, peers, or others new ways to use technology. Explain what made you really want to know more about a particular technology skill.

As the researcher, I moderated the discussion in the focus group to encourage participants to engage in informative, detailed discussion about the topic (Barbour, 2007). I paid close attention to the interaction of all of the participants in the group to make sure they were comfortable voicing their opinions. As with the interviews, I encouraged participants to ask questions if they needed clarification.

The focus group discussions were audio recorded and transcribed. To match students with their comments, I had the students wear numbered nametags and during the discussions, I took notes on the first few words each student said. This allowed me to
identify each student on the audio recording for the transcription process. During the coding process, I used the audio recording to reexamine portions of the focus group sessions for deeper understanding (Rodriguez & Brown, 2009).

**Timeline.** The 16 student study participants were seniors when the study began in the fall of 2012. The scheduling of the study in the fall allowed time for the participants to review the draft data and analysis of the study prior to graduation. I conducted the individual interviews with five students over a period of 1 week. When the interviews were completed, I analyzed the interview data to develop focus group questions over a 3-week period. Next, I conducted two focus group sessions during a 3-week period. I transcribed the focus group data immediately after each group met. When the focus group transcription was completed, I analyzed all the data and prepared a report of the results over the next 6 to 8 weeks. In the analysis process, I reviewed the data to distinguish themes and different discoveries that stood out (Creswell, 2007).

**Data Analysis**

The data analysis for this research study provided a perspective of the student voices by portraying their experience when using technology for powerful learning. I investigated the specific subject of the research question in context to reveal unique evidence from the different participants (Stake, 2010). Throughout the research process, I made connections among all the details revealed (Stake, 2010), searching for how the students understood their technology experience and to what extent that understanding suggested powerful learning occurred (Stake, 2010).

It is crucial for the qualitative researcher to perform a thorough analysis of the data to discover areas of convergence (Yin, 2009). Convergence happens when more than
one interviewee gives a similar response to an inquiry question. This results in the blending of data from different sources into the same category or code because the data bits resemble each other in some ways (Dey, 2005). The researcher conducts deep analysis to find areas where there are discrepancies (Corbin & Strauss, 2008). The discrepancies may demonstrate findings that require further questioning to detail why they occur (Corbin & Strauss, 2008).

Data analysis procedures included coding to identify specific topics uncovered in the interviews and focus group sessions. I manipulated the data using MAXQDA (Version 10, 2012) software to identify specific categories. MAXQDA software is an efficient analysis tool and provided a means for reviewing the initial data bits to find similarities and differences (Dey, 2005). In the next step, I grouped similar data for deeper analysis to uncover emerging themes. Throughout the data analysis process, I created reflective memos to provide new insight and record thoughts.

Coding, themes, and theoretical references. First-cycle codes are the initial codes used in data analysis (Saldana, 2009). The first cycle codes used in this study were in vivo codes, based on participants’ word-for-word responses (Saldana, 2009). In vivo coding allowed retention of the terminology associated with participant experiences. I displayed the in vivo codes in quotations and coded each response separately. My objective was to find statements that stood out. I highlighted these throughout the process.

The iterative and spiraling process of data analysis involved periods of repeated examination of the data to discover different meanings and interpretations. Through further analysis, I combined the codes into more general themes. Finally, I used
theoretical codes based on criteria from critical theory to examine the data for specific references about powerful learning, use of digital tools, and any marginalization experienced by the students in this context. A preliminary list of such codes was based on the results of the literature review and included the following:

- Higher test scores and/or grades (Maynard & Cheyne, 2005; Jung & Lim, 2009)
- Preference for technology use as opposed to other methods of learning (Maynard & Cheyne, 2005)
- Negative response to technology use (Vernon, 2006)
- Positive response to technology use (Vernon, 2006)
- Types of technology tools used (Greenhow et al., 2009)
- Ways technology tools were used (Banister & Fischer, 2010)
- Research skills used (Rainie, 2006)
- Type of information validation used (Rainie, 2006)
- Where technology tools were used (Greenhow et al., 2009)
- Technical problems encountered (Warschauer, 2003)
- Problem solving skills used (Burniske, 2008)
- Types of projects completed using technology tools (Solomon & Schrum, 2007)
- Types of group projects completed (Solomon & Schrum, 2007)
- What students learned
- Powerful learning codes: practical, engaging, authentic, challenging, high quality, meaningful, assistance provided by more knowledgeable other (Rivera & Rowland, 2008)

- Specific, basic knowledge and understanding taught/learned to prepare for project (Zhao et al., 2010)

- Who provided guidance to teach specific, basic skills required to complete project (London et al., 2010)

- Type of formal training on specific technology received that supported completion of the project (London et al., 2010)

**Reflective memos.** I composed self-reflective memos immediately after all data discovery (Creswell, 2007). I used the beginning memos initially to examine the data to reveal areas where more information was needed. While writing the memos, I continually refocused on the research question to center my thinking on the primary purpose of the study. In addition, I wrote subsequent memos when ideas evolved during the analysis process to express the deeper understanding evoked through the spiraling and iterative process of repeatedly looking at the data to identify new insights (Dey, 2005). I used the memo writing to document my cumulative insights and provide a way to make comparisons between my perceptions and themes that emerged from the actual student data. This process yielded a richer and more nuanced understanding of what the students were actually telling me. I wrote summary memos to combine several memos into the status of the study at particular points in time (Corbin & Strauss, 2008).

The memos provided a way for me to review and reflect on the data. The reflection involved breaking down the data into smaller bits of information, then taking
these bits of information and mixing them together again with a different outcome. The memos were important to document the insight and meaning derived from the data. This iterative process strengthened the content of the study and helped to clarify the findings.

Validity Issues

The term validity has different meanings in quantitative and qualitative research. Common terms used in a quantitative study for ensuring validity are internal and external validity and reliability. Lincoln and Guba (1985) used the terms of credibility, transferability, and dependability to describe validity in qualitative inquiry. I used Lincoln and Guba’s (1985) terminology for describing validity in this interview and focus group–based qualitative study to support the value of the findings.

Credibility. Internal validity in quantitative data analysis is the difference in an outcome, or dependent variable, directly related to a deliberate change in an independent variable (Lincoln & Guba, 1985). For this qualitative study, as proposed by Lincoln and Guba (1985), I used credibility to establish that the data were credible to the participants themselves. To establish credibility in this study, I used the method of participant checking of the data and findings recommended by Lincoln and Guba (1985). I obtained students’ signatures validating their opportunity to review the data (Appendix E).

Another way I demonstrated credibility in this study was by using a combination of data-gathering techniques, including semistructured interviews and focus group discussions. These two data-gathering methods allowed for triangulation through comparison of data derived from both methods.

Throughout the study, I used self-reflective memos to check for credibility (Corbin & Strauss, 2008). The memo writing process promoted investigative thinking
through continual reflection on the data, which facilitated linking of the different pieces of data and revealed inconsistencies. This process strengthened the value of the findings. The reflective memos helped to detail the evolution of the final analysis and support the credibility of the outcome of the study. The documentation contained in the self-reflective memos was beneficial in showing triangulation, or the validation of one source of data against another. Using the memos to compare the same evidence from different sources added credibility to the data (Lincoln & Guba, 1985).

**Transferability.** External validity in a quantitative study attempts to show an approximation that a cause and effect or correlation exists by using randomized sampling in different settings and times (Lincoln & Guba, 1985). Transferability is the term used in qualitative studies that corresponds to external validity in quantitative studies (Lincoln & Guba, 1985). Lincoln and Guba (1985) described transferability as providing detailed, descriptive data that allow a reader of the study to apply a similar research approach to his or her own context (Lincoln & Guba, 1985). The reader has the burden of asking in what way the study is similar in context to another study (Lincoln & Guba, 1985). During the research, I focused on transferability of the findings to another site with similar participants. I carefully detailed all the fundamental procedures used in this study to allow another researcher to follow the procedures in another similar study.

**Dependability.** The term reliability is another way of establishing trustworthiness in a quantitative study (Lincoln & Guba, 1985). To demonstrate reliability, the researcher replicates the results two or more times with similar results (Lincoln & Guba, 1985). The term used by Lincoln and Guba (1985) to characterize reliability in qualitative studies is dependability. Lincoln and Guba (1985) described dependability as accounting for ever-
changing context by describing the changes and their impact on the research. They further stated that researchers can establish dependability with triangulation by using multiple sources of information and by including thick description with peer examination (Lincoln & Guba, 1985). I attempted to establish dependability in support of this study’s findings by including different sources of data from the interviews and focus groups. I also compiled an audit trail (Lincoln & Guba, 1985) of documentation during the study. The documents included the reflective memos, schedules of activities, the interview questions and transcripts, and the focus group questions and transcripts. I maintained a journal of all activities, reflections, and daily notes throughout the data gathering and analysis. I documented details of the techniques used to complete the research process. The audit trail supports the dependability of the data gathering and analysis process (Lincoln & Guba, 1985).

**Role of the researcher.** In a qualitative study, the researcher’s perspective influences the data gathering and analysis. As a researcher, I had a certain perspective, and it was important that my perspective and personal feelings about the subject did not cloud what the participants were saying. The onus was on me to be thoughtful and reflective throughout the data gathering and analysis process. This ensured that I was mindful of my personal perspectives and continually conducted the research to include the participant voices on their own terms.

I practiced continual reflection. At times, my personal thoughts and feelings provided a different perspective that served to clarify or bring into question some of the revelations of the participants. I used this self-reflective process to honor the perspectives of the participants through my own perceptions as the research instrument (Creswell,
2007). By doing this, some interesting insight was revealed during the research process. My role during the study was to serve as an investigator who provided useful information for school improvement. I presented the facts as I gathered them to articulate what was happening in the school with the use of technology. Another area where I needed to stand back and reflect on the feedback received had to do with students who lacked access to technology in the home. I feel strongly about this area. By using continual self-reflection during the data gathering and analysis process, I worked to ensure I captured authentic student voices.

**Protection of Human Subjects**

The study included 16 high school students for data-gathering purposes. The students provided me a great service by volunteering their time and feedback for completing the study. To the best of my ability, I took great care to prevent any harm to the students participating in this study. To maintain confidentiality of all the data for the study, I used my password-protected personal computer. I filed all notebooks, interview transcripts, and focus group transcripts in a locked file cabinet in my home. These procedures prevented any of the data gathered for the study from becoming public information (Butin, 2010). If I predicted any anticipated threats to individual privacy, I addressed these threats immediately to make sure there were no possible breaches of trust.

I will prevent the use of the data for my personal benefit or another’s benefit by keeping the contents of the study confidential. In doing so, I will not discuss or share the information with any individuals in the school or any outside venue without the written consent of the participants and their parents (Butin, 2010). In the written thesis, I
protected the anonymity of the students by using pseudonyms and of the school district by indicating only its general geographic location. The consent form (see Appendix B) indicated that participants could opt out of the study at any time and have their data removed from the study (Butin, 2010). The consent form also included my advisor’s contact information and my personal contact information so participants could contact us at any time with their questions or concerns. I sent permission forms home for the parents’ signatures to authorize the interviews and focus group sessions. Additionally, I obtained written permission from the school superintendent to conduct the study (see Appendix C). I allowed all participants the opportunity to review all information written about them in draft form (Butin, 2010).

Conclusion

In what ways have students experienced the use of technology tools to build their digital skills by engaging in powerful learning experiences during the school day and outside of school? With the integration of technology into the lives of our students, the ability of students to use technology effectively in our information society is important for their future success in the 21st century. Technology tools provide the opportunity for students to engage in powerful learning experiences. This research sought to address the problem of practice of how students build their digital skills during the school day and outside of school by using technology for powerful learning. This interview and focus group-based qualitative study provided a method for examining what was transpiring with technology in the lives of today’s youth. Use of the student voice was important to find out what is happening in their lives with all the technology tools available. The study
sought to influence change in teaching and learning practices to prepare our students for success in our information and knowledge economy.
Chapter IV:
Research Findings

Introduction

The purpose of this study was to find out how students use technology for powerful learning. In this chapter I report the results of the analysis from the data gathered over a 2-month period. This interview- and focus group–based qualitative study included 16 high school students. The study sought to find the student voice about technology use for powerful learning inside and outside of school.

Technology tools and powerful learning can be defined in many different ways depending on the context. For this research, technology tools are electronic devices and/or software used in teaching and learning situations. Examples of technology tools in this research are communication or collaboration tools such as smart phones, Facebook, Twitter, and email. Electronic devices used as technology tools are cell phones, computers, tablets, and iPads. The software programs referred to in this study include Microsoft Word word processing software, PowerPoint presentation software, and the productivity software used in two high school vocational-technical programs. The students in the design and visual (DV) program learn how to use the Adobe Creative Suite (Version 6, 2012) (CS6) software, which includes Photoshop for photo editing, InDesign for designing publications, and Dreamweaver for designing web pages. In the TV media/theater arts (TVM) program, students create, edit, and produce videos using Apple Final Cut Pro (Version 7, 2009) and Avid Media Composer (Version 5, 2010) software programs.
The first section of this chapter provides participant descriptions. The second section discusses the themes that emerged from the student interviews, focus groups, and researchers’ reflective memos and field notes. The chapter closes with a conclusion, which summarizes the key findings of the research.

**Participant Descriptions**

**Steven.** Steven is in his final year in the TVM program. This student was polite and serious about the interview. He was thoughtful when responding to the questions. Steven focused his study on video production. He said he was a visual learner. He liked to watch videos to learn about different subjects. As an example of powerful learning with technology, Steven described how he created a wiki for a class project. The wiki, or web blog, was about the book *Speak*. Steven said he retained information about this project because he read the material over and over when he went online to update the wiki. After he completes college, Steven aspires to have a career in film. When Steven talked about using technology, he became animated. Steven thought students could use technology tools, especially cell phones, more for powerful learning.

**Nancy.** Nancy is a senior in the TVM program. She said an example of powerful learning with technology was working with Apple Final Cut Pro Motion software, which she used to create captions for video projects. Nancy was proud that she understood how to use this complex software. She enjoyed applying her creativity with the Apple Final Cut Pro Motion software to create video captions that display as falling paint drops. She talked about the changes in learning with the technology now available, stating, “It is a different way of learning. It really is. Some people, when they are little, they use books to learn. Ways are changing quickly.”
**Ted.** Ted is enrolled in his final year in the TVM program. An avid sports fan, he centered his video projects on sports whenever possible. Ted found that the practice of audio recording interviews was a powerful learning experience. Recording the interviews allowed him to focus on asking questions and listening to the responses without having to take handwritten notes. Ted said having audio recordings was convenient when writing up the final interviews, allowing him to listen to the recording over and over. Ted hoped to work in the sports casting field when he graduated from college.

**Mary.** Mary is a senior in the TVM program. She impressed me as an independent learner. Whenever possible, Mary used technology for learning. During middle school, Mary moved to the United States from Great Britain. She said that she found the two education systems very different, and it was difficult to get used to the system in the United States. To help her with the transition to the United States, her teacher explained how she could learn just about anything online: “My fifth grade teacher . . . showed me every single thing you need [was] online. So, I just used that all through middle school and all through high school.”

**Carmella.** Carmella is a senior in the DV program. Although she appeared quiet in class, she was animated during the interview and provided many valuable ideas. Carmella had a quick sense of humor. She gave learning examples connected with her being an only child and using technology to occupy her time. She stated, “When I was little, I played a bunch of learning games. I was an only child so [you know] I entertained myself with video games and computer games. Your parents only want to play Candyland with you so many times.” One memorable quote from the interview was about her father who told her to “use technology for good not evil.”
Focus group participants. During the two focus group discussions with students from DV and TVM, the students demonstrated team collaboration. Everyone was allowed time to speak and voice their opinions without criticism. The students knew each other well from participating in their technical programs all day every other week. The limited amount of time with the students did not allow for capturing in-depth knowledge about individual students. Instead, this section provides a contextual description of the focus groups as a whole. The distinct group personalities of the two focus groups became evident during their discussions. For confidentiality purposes, the student names have been changed.

The first focus group consisted of six students, two males and four females. This group had an equal mix of students from each technical program: Natasha, Demi, and Andrew from TVM and Kent, Flowie, and Wendy from DV. This was a compatible, serious group. The students were comfortable participating in the discussions. Wendy, Andrew, and Natasha were the most talkative; however, they allowed everyone to speak and did not criticize anyone’s ideas. Wendy had an opinion on everything. With her friendly personality, she gave her sometimes controversial opinions, demonstrating to the group that she could do so without being criticized. Wendy voiced her frustration about the content filter for school Internet usage, stating, “The filters are kind of ridiculous because sometimes you would get blocked for looking up images.” Demi, Kent, and Flowie were quiet at first. Wendy’s eagerness to speak up set the tone for the group and soon everyone was comfortable speaking freely during the discussions. Once they got started, the students had so many comments to provide, there were no periods of silence. The students were friendly to each other and respected each other’s opinions, even
though they did not always agree. The students discussed technology as problem solvers, each one offering his or her ideas about using technology to improve learning. This group required little moderator intervention to keep them on the topic. The students were happy to have a chance to voice their opinions, as evidenced by their continuous discussions.

There were five students in the second focus group: Maria, Mandy, and Buddy from TVM and Gina and Gabby from DV. The only male in the group, Buddy, did not hesitate to offer his comments throughout the discussion. This group laughed a lot and had a good time. They did not always agree. They did not take the topic of technology too seriously. During the discussions, this group showed their ability to work as a team. One member, Maria, stood out at times as the leader. At one point during a discussion, Maria caught herself answering for the group and backtracked to allow others to respond. The group enjoyed discussing how they taught their parents about technology. Gabby and Buddy were the quietest members of the group. Gabby broke the ice at the beginning of the discussion, though. When the timer on my phone went off by accident, Gabby told everyone the noise from my phone was her texting me, giving me all the answers. Her comment made everyone laugh. This set the tone for the focus group session as one of comfortable conversation where you could use humor to tell your stories. Although the nature of the group was upbeat and funny, the students became more serious whenever they spoke about the technology they used in their technical programs.

Themes

Using the individual interview data, three primary themes emerged that then led to these findings. The themes that emerged following the interviews guided the focus groups, and consistent themes emerged from the focus group data as well. A combination
of both the interview and focus group transcripts provided more robust data, especially given that there were consistent themes among them. The iterative process of data analysis allowed me to further combine the focus group and interview data to show how these students described their relationship with technology use and powerful learning. This section traces the evolution of those themes and shows how they evolved. The primary themes are as follows:

1. Technology fosters independent and interdependent learning.
   — Independent learning with online tutorials
   — Communication/collaboration tools
   — Technology-based activities that motivated students
   — Learning from/teaching others—interdependent learning

2. Teacher skill and comfort with technology make a difference.
   — Appreciation for teachers’ integration of technology
   — The challenges of instructor reticence about technology
   — Students not wanting to teach teachers about technology

3. Access to technology impacts powerful learning opportunities.
   — Access to technology tools at home
   — Blocking of online resources by the school’s Internet content filter
   — Inconsistency in school policy regarding cell phone use

Table 2 displays the primary themes that emerged from the interviews and focus groups with definitions and examples.
### Table 2

*Primary Themes from Interviews and Focus Groups with Examples*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
<th>Example(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology fosters independent and interdependent learning</td>
<td>Student takes the initiative to use technology to learn more from others or learns through collaboration with others without being told</td>
<td>Student uses her cell phone to text friends to ask for help in solving a precalculus problem</td>
</tr>
<tr>
<td></td>
<td>a. Communication/collaboration tool</td>
<td>a. Implements, devices, utilities, applications (apps), equipment, means, or gadgets used for connecting with others to give or receive information</td>
</tr>
<tr>
<td></td>
<td>b. Learning strategies</td>
<td>b. Using technology to build knowledge</td>
</tr>
<tr>
<td></td>
<td>c. Learning from/teaching others</td>
<td>c. Using technology to become more informed through the influence of another person or using technology to teach someone else a new skill</td>
</tr>
<tr>
<td>Teacher skill and comfort with technology make a difference</td>
<td>a. Skills or knowledge teachers have about using technology to enhance teaching and learning practices</td>
<td>a. Student accesses the teacher's website after school to review the PowerPoint presented during class</td>
</tr>
<tr>
<td></td>
<td>b. Instructor reticence about technology tends to backfire</td>
<td>b. Teachers do not use iPads because they do not have the skills to integrate this technology into their lessons</td>
</tr>
<tr>
<td></td>
<td>c. Students don’t want to be responsible for teaching teachers about technology</td>
<td>c. Students have to teach the teachers how to use the iPads, wasting valuable class time</td>
</tr>
<tr>
<td>Access to technology impacts powerful learning experiences</td>
<td>Availability of technology inside or outside of school</td>
<td>Student has access to online information and technology tools to support learning</td>
</tr>
<tr>
<td></td>
<td>a. Communication/collaboration tool</td>
<td>a. Implements, devices, utilities, applications (apps), equipment, means, or gadgets used for connecting with others to give or receive information</td>
</tr>
</tbody>
</table>
**Theme 1: Technology fosters independent and interdependent learning.** The first primary theme that emerged from the analysis of the data was how technology fostered independent and interdependent learning. The students provided examples of this throughout the interviews and focus groups, including examples of solving problems by taking the initiative to become independent learners. Students located online tutorials to learn independently.

*Independent learning with online tutorials.* When students wanted to learn how to use new software, they went online and searched for training videos. Students found step-by-step tutorials, videos, and images. Students commented that this really helped them to learn. When using technology, students made this effort on their own if they became frustrated from not understanding how to do something. Andrew stated,

> I have a program on my computer that I use to produce music, and when I first picked it up, it was totally foreign to me. I was used to using a much simpler program. I started watching videos online and learning different ways to do it and also learned different aspects of different styles of music. I just combined the two different styles of what I was learning to really bring it together a lot better.

Buddy spoke about his experience using tutorials on the Internet as well:

> Yeah, you can just type in whatever you want for a tutorial, and it will give you so much stuff. So I mean basically, sometimes when teachers can’t explain things to you, the Internet does help more. Because the teachers know what they are talking about, but sometimes they don’t explain it to you in a way that you can comprehend it. So sometimes, the Internet would give you more, better logic on your own of what you could understand easier.
Students reported that when they did not know how to use the software in their technical program, it provoked them to want to learn more. Gina stated,

In shop [DV], when we were learning how to use Photoshop, if we had trouble learning it, we could just use the Internet and search tutorials. It would give us step-by-step [instructions]. So, even if the teacher is learning with us, the Internet helped us in learning what to do and show you step by step. It shows you images and where to go. It even had videos and that really helped.

During their discussion about their ability to learn independently, Kent spoke about his experience of learning how to create parchment paper. He said, “I had to make parchment for one of my designs, and I didn’t understand how to do it completely. So, I went on a website with a video tutorial.” Kent described how he learned by using the Internet:

If I don’t understand how to do something, I look it up on the Internet. [If] I don’t exactly understand, I will try to find a video tutorial so I can pause it at one point and try to do it and figure out what they did from there. So at least if I cannot understand it, at least by thinking about it I can at least see it visually and do it from there.

Wendy, a DV student, stated,

[We were] making 3-D models, which was really cool. What I learned from my teacher was not the most straightforward thing because it is kind of a complicated thing. I went on the Internet, obviously; and there is an abundance of tutorials on YouTube and websites where they teach you.
**Communication/collaboration tools.** When students reported on how they used communication and collaboration tools for powerful learning during the interviews, I captured this information. Table 3 displays the tools used and an example of a powerful learning experience for each interviewee.

Table 3
**Communication/Collaboration Tools Used by Interview Participants**

<table>
<thead>
<tr>
<th>Student</th>
<th>Tool</th>
<th>Example of powerful learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steven</td>
<td>Laptop</td>
<td>Read current news articles online</td>
</tr>
<tr>
<td>Ted</td>
<td>Smartphone, Twitter, Google</td>
<td>Found it useful for “getting his opinion out there” about sports and finding current information</td>
</tr>
<tr>
<td>Nancy</td>
<td>Phone, Internet</td>
<td>Used the Spanish-English dictionary and as a research tool in Spanish class</td>
</tr>
<tr>
<td>Mary</td>
<td>Internet, YouTube, PowerPoint presentations</td>
<td>Used Internet to reinforce organic chemistry knowledge and learn Algebra II concepts</td>
</tr>
<tr>
<td>Carmella</td>
<td>Internet, iPad, YouTube</td>
<td>Used AP Biology lab video on YouTube as a reference while completing the lab in class</td>
</tr>
</tbody>
</table>

To find out more about the tools students used for collaboration and communication, I developed a technology tool checklist for the focus groups, in which students indicated whether they used Twitter, Facebook, Tumblr, chat, text, Skype, phone, blog, and wiki. A space was also provided for students to add other tools. During both focus group sessions, the students completed the check-off sheet to document the collaboration/communication tools they used. Figure 1 displays a graph of the most common tools, based on the tools that students chose more than once on the check-off sheet. The highest number is for phone use. This number is not surprising, with 32 references to phones found during a review of the interview transcripts and 30 references during the focus group sessions. For a definition of each tool, see Appendix D.
Figure 1. Student choices of technology tools used for collaboration and communication.

*Phones.* During all the interviews and focus groups, students made references to using phones for some learning functions. The students mentioned phones more than any other tool for learning with technology. Students repeatedly described using their phones for powerful learning experiences. They gave examples of using their phones to take pictures of assignments. Andrew said, “I will just sometimes take a picture of a page in my math book.” The students used their phones to create videos for classroom assignments. Steven said,

[As] an example for [the] phone, . . . one of the juniors, Charlie, he used his camera to make a video. . . . But seeing how like Charlie used his phone to make a video, it was really unique. I feel like that is a potential resource if used in the
right way that a lot of us take for granted or don’t really understand what potential it has.

Students used their phones as reminder devices and classroom resources. Buddy used his phone as a reminder tool and notebook. He talked about “writing all my work down on my phone and saving it and just progressing there throughout the day.” Additionally, when students became frustrated with the blocked Internet sites at school, they used their cell phones as a learning resource to access the blocked information. During his interview, Ted told me that his phone is a learning resource. When Ted was working on a team project about the presidential election, his team had difficulty locating information due to blocked sites on the school Internet. Ted said, “I believe some people happened to do it [the research] on their phones . . . [over] the Wi-Fi.”

Technology-based activities that motivated students. The students gave examples of how technology-based activities motivated them to learn. Students reported designing their own technology-based projects. They suggested ways to make learning fun and more meaningful by using technology and described projects that give them autonomy and motivated them to work hard.

Students described the “passion projects” they created in TVM and “pet projects” they designed in DV. Both the passion and pet projects allowed students to customize their learning by working on a project they designed. The projects were aligned with the competencies in their technical program curricula. Steven said the passion project assigned to students in TVM caused him to “like to learn.” He said he would sometimes “just go through the motions in school.” Steven explained that a passion project was a project about a topic that strongly interests you. Having the freedom to work on
something that he “was really kind of into and felt strongly about” provoked Steven to “go above and beyond what was required because it was something I was really into.” Steven said if students had the opportunity to complete passion projects, it would “open their eyes and help them see what you could do with technology.” One of his projects was about the Celtics because of his passion for basketball. Mary described her passion project in TVM about spoken word poetry. She said projects like this would encourage students to use technology to support their learning. Mary incorporated video clips from YouTube in her passion project. She explained:

Sophomore year I did a passion project on poetry. It is spoken word. It is poetry and they are talking to you and telling you a story. It is so powerful. I showcased that [in] my PowerPoint. No one knew what spoken poetry was, and they really liked it. Oh my goodness, you have to see it. It is so good. The way they use their words, it is amazing. . . . I am into poetry so I went on YouTube one day, and I just put in poetry and I just saw this guy, he was at a competition in California for teenagers who have been through worse things in their lives. And he wrote a poem about his friend who was in a wheelchair and then it was so weird how he—I don’t even know how to explain it. He put math in it. I don’t even know. You just have to see it. You can’t explain it.

Carmella enjoyed working on her pet projects in DV. She stated,

It is like we get this idea to do something. You want to make a poster or something for somebody. . . . Sometimes your pet project is just you messing around with new brushes or effects or things you downloaded that you want to see how they work, but you don’t want to use them in a real project because you want
your real project to look nice. You [may] find out that this thing that you downloaded doesn’t look good at all. It is just like little things that we do to occupy our time when we are in between projects and it helps [you] keep [up with] your ideas and your creativity.

Students also reported that they were encouraged to use technology for powerful learning when they were made aware of online learning resources. Mary gave the example of her biology teacher recommending websites to students that would help them understand the material better. She stated that most students do not “really go beyond to research what they don’t understand.” Mary said that students get discouraged when they do not understand what is going on in the classroom. These students, Mary said, “would not know what to do. So, they wouldn’t really use technology to further understand it. They will just get discouraged and not try.”

A student in TVM, Buddy, reported that he used online resources to learn “how to do special effects with Avid or Final Cut,” the software tools used to create video productions. Maria shared her experience about looking for references for her senior project. She described finding a blog that was useful: “It was really hard to find [information] at first but I ended up finding this guy’s blog and he blogged one [project] that he did, and I tried to do it similar to what he did.” This gave her an example she used for the basis of her final project. Buddy gave an example about how he forgot to cite one of the sources in his senior project paper. The librarian told him that he could search online using a section of his quote. By doing this, he found the original citation for his project. Buddy stated,
Our library teacher . . . [said] that you can highlight everything from what you got off the Internet, the paragraph or so, and just paste that onto a search on Google [and] basically that would show up [with the author] again.

**Learning from/teaching others—interdependent learning.** During the interviews and focus groups, students provided examples of learning from and teaching others, as displayed in Table 4.

<table>
<thead>
<tr>
<th>Learned from</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>• Using iPad to access app to build math skills</td>
</tr>
<tr>
<td></td>
<td>• Using math, science, and word games for learning</td>
</tr>
<tr>
<td></td>
<td>• Building skills after theory lessons by using teachers’ printed</td>
</tr>
<tr>
<td></td>
<td>instructions when completing hands-on projects</td>
</tr>
<tr>
<td></td>
<td>• Pasting the actual Dreamweaver code into a YouTube search box to</td>
</tr>
<tr>
<td></td>
<td>find training videos</td>
</tr>
<tr>
<td>Friends/classmates</td>
<td>• Using Instagram</td>
</tr>
<tr>
<td></td>
<td>• Using Twitter</td>
</tr>
<tr>
<td></td>
<td>• Understanding what Four Square is</td>
</tr>
<tr>
<td></td>
<td>• Completing technical program projects</td>
</tr>
<tr>
<td></td>
<td>• Using Apple Final Cut Pro Motion software to create video captions</td>
</tr>
<tr>
<td></td>
<td>• Answering technical program questions after teachers’ formal</td>
</tr>
<tr>
<td></td>
<td>instruction, helping friend understand theory instruction</td>
</tr>
<tr>
<td></td>
<td>• Critiquing each other’s work</td>
</tr>
</tbody>
</table>

The students described how they learned valuable technology skills from teachers and their peers. Additionally, students provided examples of teaching others technology skills. Steven said if students do not know the capabilities of technology, they might not use it for powerful learning. He stated,

> If teachers and students . . . became more . . . informed, I guess, about uses of technology, not necessarily just computers, but technology outside of like the
standard PowerPoint, or outside of the standard essay, that would help. So, again, long story short, just like maybe if students and teachers are informed of how to use technology to make it more interesting, they will be more into the lesson or the topic.

Carmella expressed her concern about students becoming discouraged about technology and giving up. She said students “might be intimidated” with technology and might say, “I don’t know what this is. I am afraid I am going to break it.” She helped her friends learn and did not do the work for them. Instead, she told them which menus to use and let them carry out the steps themselves. She said if she did the work for them, her friends would not learn. Nancy said she learned how to use Apple Final Cut Pro Motion, a software program used to create video captions, from another student:

One of the students I am in shop [TVM] with, she started using it [Apple Final Cut Pro Motion] first. She showed me [how to use it] one day. I did not learn that from my teachers. Sometimes, if I get lost, I would have them [my teachers] help me. The girl in my class really showed me how to use it. I really learned that from her. One day we were doing this project and I said I really want to do [Apple Final Cut Pro] Motion with this because it is fun. I am not very good at editing, I said, so I will do this [instead]. Yeah, that is how I figured it out. We did a project together, and she showed me how to do it, then I figured it out. Then I was on my own.

The students discussed how they learned from their friends or other students. During the second focus group session, Gina described how she tutored her friend after
their theory instruction on technical program projects. She helped her friend understand the concepts better. She said,

I know for a fact that I help [my classmate] out a lot if she has a question. I feel like I am teaching her how to do it and she understands it better when I teach it than when the teacher does.

Students taught each other technology skills when they discovered that their friends did not know how to use a specific tool. Gina told the group about how she was at her friend’s house and they were talking about Twitter. Gina admitted to her friend that she did not know how to use Twitter. Gina stated, “She was telling me I should get Twitter, blah, blah, blah. I had one [a Twitter account]. I just never really knew how to use it. She was teaching me. I was like, oh, it’s that easy. I felt kind of stupid.” Students admitted what they did not know and their friends helped them learn about unfamiliar tools.

When students completed projects, they asked their peers for advice. As Gabby reported, “If you are stuck you don’t really ask the teacher, you ask the people around you.” They critiqued each other’s work to improve on it. Gabby said, “I usually gather the people around me and ask them to tell me, to critique my work, look at it, tell me what is wrong with it.”

Students responded to the interview and focus group question about what they wanted to learn from or teach others about technology with recommendations for interdependent learning. They used this opportunity to include their recommendations for teachers’ technology skills with specific examples of what they thought their teachers
needed to learn. The student responses are listed in Table 5. Students connected their responses to their own learning and to that of friends, teachers, or family members.

Table 5
What Students Want to Teach or Learn from Others

<table>
<thead>
<tr>
<th>Participant(s)</th>
<th>Technology skill</th>
</tr>
</thead>
</table>
| Learn from teacher                   | • Avid video production software  
|                                      | • Video camera shortcuts            
|                                      | • Educational games available for skill building                                   |
| Teach or learn from friends          | • How to use Instagram              |
|                                      | • How to use Apple Final Cut Pro Motion software to make video captions           |
|                                      | • How to use the Internet to get help with learning                               |
|                                      | • Help others retain technology skills with practical experience                   |
|                                      |   o just use it                     |
|                                      |   o trial and error                  |
|                                      |   o play with it                     |
| Training recommended for teachers    | • What to do when the Smartboard stops working during class                       |
|                                      | • How to use iPads                   |
|                                      |   o Change screen content size by using fingers to zoom in and expand              |
|                                      |   o Move screen items by touching things and dragging them with their finger      |
|                                      |   o Learn about iPad apps and computer programs that are relevant to teaching their subject |
| Teach family members                 | • How to use Facebook                |
|                                      |   o Upload video                     |
|                                      |   o Navigate with tabs               |
|                                      | • How to text                        |
|                                      | • Computer skills, such as how to use Word                                       |
|                                      | • How to set up printers             |
|                                      | • How to configure phone contacts    |

**Theme 2: Teacher skill and comfort with technology make a difference.** The second primary theme that emerged from the interviews and focus groups was the role of teacher skills and comfort with technology. Three subthemes emerged:
1. Students appreciate it when teachers integrate technology into their learning.

2. Instructor reticence about technology tends to backfire.

3. Students do not want to be responsible for teaching teachers about technology.

*Appreciation for teachers’ integration of technology.* Mary commented that “the way some teachers teach, not every student would understand the way they teach.” To help students learn, she recommended giving students an option to find other styles of teaching online that are more geared to their learning styles. She explained:

This was sophomore year and in Algebra II, I didn’t understand the way my teacher was teaching. . . . The way she explained it she was just so confusing. I would ask her for help, but she would just explain [in the same way] again. So, I figured I would just go through in a different direction and I went online and I found this website, it is all about Algebra II. And it is a teacher, it is an audio voice that will show you the problem and they will explain how to do it step by step. And they will have different ways of doing the problem.

Students said they wanted teachers to provide more instruction about technology and use more technology. Andrew gave an example:

We have only used them [iPads] once in math, but they have an app that would test you more on your weaknesses than your strengths. So if you answered a question wrong, you got more questions with a similar kind of a problem. Whereas if you got it right, you wouldn’t get as many.

The data on the students learning from the teachers included strategies for students to use for independent learning after formal lessons. The students appreciated it when their instructors provided alternate ways for them to learn difficult concepts. For
example, Gina told a story about becoming frustrated when she was trying to learn how to use Dreamweaver software to create a web page. She did not understand the teacher’s instructions and the instructor helped her learn how to use YouTube to search for training. Gina said,

I didn't really understand what he [the instructor] meant by pulling a shape onto the workspace, onto the site, and having it be something else. I didn't understand that. And so we actually had to do it all together. The way he was explaining it to me confused me so much. He actually showed me the coding and what things would happen if I did the coding correctly. It was really interesting. He did it from the YouTube web page. You took the coding and just put it in, and it came up in the gray box.

Hands-on activities, such as games, encouraged students to use the technology for powerful learning. Carmella described an online scavenger hunt her English instructor used to teach research skills. She said, “You were helping Sherlock Holmes solve a case.” Carmella said if her math teacher told the class they were going to do 50 math problems as a review, the class would not look forward to it. However, “if you put it as a game, you [students] are so much more willing to do it.” Jeopardy was suggested as a learning game by Carmella. Carmella said, “But if you [say], ‘Let’s play Jeopardy,’ you [students say], ‘Okay, yeah, I can try to do that really hard math problem.’”

The challenges of instructor reticence about technology. Another subtheme that emerged from the interviews and focus groups was the challenges that emerged when the instructor was reticent about technology. For example, when doing research, students wanted to be able to use online information along with books by properly validating the
online resources. Wendy stated that teachers could help students “make proper judgment” but instead “they just really don’t utilize it.” She understood that instructors were apprehensive about the students using online resources because of bias. Wendy stated,

What you need to do is look at multiple sources and compare what they say about these things because everyone has a different opinion on some things and you just need to be able to work around the opinions and get to the facts that the people state within their opinion.

Teacher technology skills impacted the students, as evidenced by student comments in the research. Natasha said,

If I was a teacher and they were bringing in all this technology that I did not know how to use, I would be, quite honestly, be scared that I would lose my job to someone younger. That is a big point if you don’t know how to use it and you are supposed to be teaching [the] students with it, that is kind of pointless.

The students were frustrated that the teachers did not always know how to use the iPads to help students learn. Andrew stated,

My teacher, since she didn’t know much about how to use the iPads, the real details about using the iPad, she was really not acceptant of the technology, and she was doing it more because she had to and less because she wanted to use it as a tool to help us learn.

In school, students wanted to use the iPads more. The students were disappointed that their teachers were not willing to integrate the iPads more into instruction. Andrew stated,
I think at school iPads, they are available but the one downside of it is a lot of teachers don't look at them in a positive light because they don't know how to use them as well as we know how to use them. So, I think it's a turn off for them, especially when they get stuck with what they are doing. They are at a standstill and don't know what to do. So, I mean it's good to have them but not a lot of teachers want to use them because of that fact.

Gina stated,

I do wish we used iPads more in school. That would be cool. . . . [Our teacher] brought us down to the library to use the iPads and [the librarian] was there. We went down and we haven't gone down since. I haven't touched an iPad since.

The discussion about iPad use evoked negative comments from students about their teachers. Wendy stated,

Honestly, I think that this school has embraced a little bit of technology. We have one set of iPads and you have to rent them out and stuff, but I think the teachers need to be caught up on all the technology. We can sit down at a computer and we can figure it out fairly quick, but someone much older than us, they are going to sit down and say “I don’t know how to do this; I don't know how to close this thing.”

The students’ comments about the integration of technology into their learning showed that they wanted to be challenged. Carmella said she was discouraged from using technology for powerful learning when her assignments were not interesting or meaningful. She gave an example of an assignment that required her to complete
exercises to learn how to use Adobe Creative Suite 6 (Version 6, 2012) (CS6) software. Learning the basics of CS6 did not challenge Carmella, even though she realized it was important for her to learn. Carmella stated,

We have these review packets in shop because we are switching from CS3 to CS6 and they are really obnoxious because they have this really basic stuff. But, some of the menus got changed around, so I get why we do it, but it is really, really obnoxious. And so we do it and we have the packet for like [a] week and you work on it on your free time in the morning and some of us will wait until the last minute to do it because we really know how to do it because it is really easy. It will be like click this button to make text to do things. . . . I already know how to do this; why do I have to learn it again? You know, [you] are like: I want to work on my pet project. I want to make this thing for my friend, this funny joke picture.

Steven’s comments were in agreement with Carmella’s. He stated that students could be discouraged from using technology if they were “continuously assigned just writing essays or doing a PowerPoint presentation on the Civil War or something,” instead of a passion project. Steven considered the passion projects challenging.

Students not wanting to teach teachers about technology. Students told stories about classroom experiences when teachers did not know how to use technology and indicated that they resented teaching their teachers. Buddy said, “When we are using the iPads in class, we basically spend most of [the] time trying to show them [the teachers] what to do. So we are not really learning what we are supposed to.” Another student said that the teachers wasted valuable class time telling the students how to use the iPads when they already knew how to use them. Wendy said, “Teachers teach us things that we
already know.” Students wanted their teachers to receive professional development on how to use the iPads. Natasha said, “They have professional development days for teachers; maybe have something like that [for iPads] where they go through a workshop.”

Some teachers received professional development on the iPads and the students related their experiences about what happened after the training. Wendy stated,

They show them how, they teach them how to use the iPads . . . but they don't teach them why it's good to use it. They don't show them the programs that are relevant to their subject. They don't show them the statistics of children learning. The teachers see this as giving kids another way to goof off. There are going to be kids that are going to goof off but in a general sense kids like technology. Kids find technology interesting; that is why educational video games are some of the best learning tools. You are learning but it doesn't feel like you are learning. It doesn't feel like you are being pressured into doing something that you don't really want to do.

During the focus group discussions, the students did not comment about ways to teach their instructors technology skills, even though the students admitted they had stronger skills in some areas. They recommended professional development for their teachers to help build their technology skills. Maria’s perspective was that with technology, you have to learn on your own, instead of having others teach you. She said, “I don’t think it’s teaching. I think it is more of the benefit of you learning by trial and error. With the technology, no one was, ‘Let me teach you how to use this.’” Maria discussed how beneficial it was to learn how to do things yourself, even for her teachers. She said,
Even like with the Smartboards, the light will be out, and they don’t know what to do. They will be freaking out because they don’t know what to do. It is okay, there are only so many things it can be. If you stand up on a desk and figure it out, it’s the best way you can learn. Because if someone comes in and they [say] it’s the light bulb and they [their teacher] is then asking, “Why was it the light bulb?”, the next time it happens again, they are not going to figure it out, and they are going to call you again and need your help. . . . If you force them to do it themselves and learn it themselves, it will be better. It is like the saying about the fish: If you teach a man to catch a fish, he will eat for the rest of his life. . . . Honestly, it is trial and error in my opinion.

Mandy agreed with Maria, stating,

I agree with her. We grew up with it. We basically taught ourselves. I know [basically] everything I know about technology I taught myself. We have just kind of adapted to the whole having computers and phones everywhere in our lives. I think that’s [probably] the best way to do it. If you have any additional questions, you can go to the people that know even more than you do about it. . . . I think definitely going in and just at first teaching yourself about it is definitely helpful.

Maria provided another example of independent learning as well:

When we got the new Apples [IMac computers] we had Motion [Apple Final Cut Pro Motion] software on it, and nobody really knew what it was, and I wanted to learn it before we learned it [from the teachers]. So, I figured it out. I took 2 or 3 days, and I was trying to figure out the entire program. I got wicked frustrated.
The students reported having better technology skills than some of their teachers. The students reported a few instances of reluctantly teaching their teachers how to use technology; however, they shared numerous positive stories about teaching their family members and peers technology skills. Mandy cited an example of answering her dad’s computer questions.

I know I definitely teach my dad a lot about computers almost every day. . . . I am kind of assisting him all the time. He will ask me questions about stuff on his computer. So, anything that I can do to help him out with anything, I am just kind of always around to help with that. So it makes me happy to do it.

**Theme 3: Access to technology impacts opportunities for powerful learning.**

The third primary theme that emerged from the interviews and focus groups was the idea of students being able to access the information and tools they use for learning. During the interviews, the students reported on the methods they use to access information and the technology tools they wanted to use for powerful learning. The tools students wanted to use, as displayed in Table 6, evidenced the theme of access to technology impacting powerful learning opportunities. Results related to three main areas: access to technology tools at home, blocking of online resources by the school’s Internet content filter, and school policy on cell phone use.
Table 6  
*Technology Tools Interviewees Wanted to Use for Powerful Learning Projects*

<table>
<thead>
<tr>
<th>Technology tool</th>
<th>Total students requesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe Creative Suite 6 design software at home</td>
<td>1</td>
</tr>
<tr>
<td>Audio and video software</td>
<td>2</td>
</tr>
<tr>
<td>Audio headset for collaboration during video capture</td>
<td>1</td>
</tr>
<tr>
<td>Avid video editing software at home</td>
<td>1</td>
</tr>
<tr>
<td>Email</td>
<td>1</td>
</tr>
<tr>
<td>Excel software to organize information</td>
<td>1</td>
</tr>
<tr>
<td>Facebook to post questions</td>
<td>1</td>
</tr>
<tr>
<td>Google</td>
<td>1</td>
</tr>
<tr>
<td>Internet</td>
<td>3</td>
</tr>
<tr>
<td>iPad</td>
<td>1</td>
</tr>
<tr>
<td>Laptop or computer at home</td>
<td>2</td>
</tr>
<tr>
<td>Phone</td>
<td>3</td>
</tr>
<tr>
<td>PowerPoint software</td>
<td>2</td>
</tr>
<tr>
<td>Skype</td>
<td>1</td>
</tr>
<tr>
<td>Video editing software updated for easier use</td>
<td>1</td>
</tr>
<tr>
<td>Voice recorder</td>
<td>1</td>
</tr>
<tr>
<td>Word software</td>
<td>2</td>
</tr>
</tbody>
</table>

*Access to technology tools at home.* The theme of access emerged during the interviews and focus groups when students gave examples of how they could not afford to access their technical program software at home. The students in the interviews and focus groups wanted access to specific technology at home. They said having access at home to the software they used in their technical programs would support powerful learning. The Avid Media Composer software program used in TVM and the Adobe Creative Suite software used in DV was expensive, costing $500 to $1,000. Some students could not afford the software and thus could not access these tools at home. Sean said, “Having access to Avid at home somehow would make things a lot easier.” Mary explained why access to the Avid software at home would benefit her:
And that would help us tremendously in shop [TVM]. If we could take [the] software home and actually do a project at home, [the projects] would turn out so much better. We could even do more projects outside of school and bring [them] into school. That would really help.

Mary commented on the expense of the software: “Unless you want to pay a grand for it; it’s expensive.”

**Blocking of online resources by the school’s Internet content filter.** The theme of access emerged when the students reported on the school’s content filter blocking them from Internet sites they needed for learning. This frequent comment was evidenced by the word “block” appearing nine times in three different interview transcripts.

One of the participants’ concerns related to their inability to access Google docs and personal email accounts at school. The school Internet filter blocked Google docs, an online document storage, creation, and editing site. Wendy stated, “I think Google docs is blocked too, which is a really good site. That is one of those things that shouldn’t be blocked. It’s not email; it’s a storage system for documents.” Personal emails were also blocked by the filter at school. Students could not use their personal email to communicate with teachers. Students preferred to email their essays to their teachers rather than store them on flash drives to transport them to and from school. Andrew said,

A lot of the time when you are trying to do essays for English class, you have to put it on a flash drive because there is no way to email it. That’s another thing that’s blocked—email—but if you email a paper to yourself, you can’t open it at school. So, if you don’t have [it on] a flash drive at school, you can’t open it.
Students also discussed the impact of the filter blocking Internet blogs. Andrew said, “The school’s computers actually block anything that is a blog; they block the key word *blog.*” Wendy wanted to look up information for a customer’s design, and the school’s filter blocked her from the customer’s blog. She said, “Sometimes blog websites will be blocked but they are actually very useful for my project in that people will give personal insight into their project more so than just the professional aspect of it.”

Carmella was frustrated because her access was restricted by the filters in school. She said that unblocking blogs on the school Internet filter would encourage technology use for powerful learning. She gave an example of trying to access a blog about advertising for her senior project. The school’s Internet content filter blocked the site, so she had to do all the research at home. Demi agreed: “Sometimes you have to go home and look it up on Google because a lot of the sites are blocked and there is nothing really bad on the website.” Carmella said, “It is really annoying when you are doing research and then you get a blog about something and the blog is blocked.”

Though the students did their research in spite of the roadblocks, Natasha stated,

I feel like sometimes the websites that will be really useful to me, those are the ones that will be blocked too. So I feel like I could be getting better information than [what] I kind of settle for.

When the filter blocked information, the students said they wasted a lot of time trying to find the information they needed. Demi said that “it is a long process.”

Andrew felt that the Internet restrictions could be removed if students used the Internet responsibly and recommended the students be educated about appropriate school computer use. He believed this measure would lessen the need for such strict filtering that
interferes with access to educational information. Andrew stated, “I feel like the best way to kind of work around the need for heavy censorship is to really educate the students on what is appropriate and what is inappropriate to do on the school computers.”

Some of the blocks to online content were related not to filtering but to costs or rights. Ted gave the example of not being able to locate any articles related to his senior project topic of sports broadcasting. The librarian located a 300-page article about the history of sports casting for him. The librarian had access rights to online periodicals that were not accessible to students. Ted said,

[The librarian] found a pdf file that only she can log into. . . . Technology, the way it is today, it was still hard for me to find stuff on sports announcing, and she found a 300-page article.

Andrew also related a story about his inability to find resources for his senior project. He valued the assistance of the librarian, who provided the online resources the students could not access. Andrew stated, “I didn’t have any paper resources that I could use [for my senior project] until the librarian had to order them from other locations because we just don’t have books that directly relate to my topic.”

School policy regarding cell phone use. The theme of access emerged during the interviews and focus groups when students discussed how they were not supposed to use their cell phones in class for learning purposes. A student reported her frustration that the use of cell phones was encouraged for learning and then stopped. This student said she was disappointed because using her phone as a reminder helped her to remember all assignments and teacher expectations. Her phone was always with her. Maria said,
When we got to use our cell phones in class, I would make a notepad and say this is what I have to do today, do this, do this, make sure this is due for tomorrow, bring this in. I would never forget it; you don't ever forget your phone, so it is always there. So it is much more convenient.

The students gave examples of technology being used and some associated challenges, as displayed in Table 7.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Uses</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| Electronic books | • Download a pdf copy of math book  
• Access textbook website on phone or other device | • Use is not always allowed in school |
| Phones | • Use at school to record assignments and add reminders, photograph assignments, make videos, access information  
• Use at home for similar purposes as well as to text classmates with questions | |
| Laptop | • Use laptop during technical week to complete assignments | |
| Social media | • Collaborate on group assignments outside of school | • Blocked by content filter in school |
| School’s wireless network | • Use cell phones, iPads, iPods, or laptops on wireless network when teachers allow | • Content blocked, including blogs, Facebook, certain images, YouTube videos, some book sites, Google docs, and email |
| iPad carts (four available in the school) | • Use online math program to improve weak skills  
• Prefer that teachers use more, since students enjoy them | • “Teachers do not really want to use the iPads because they do not know how”  
• Students spend time showing teachers how to use them |
| Google docs and email | • Are useful for submitting assignments to teachers or continuing work on assignments from home | • No access to email or Google docs from outside school; USB drives needed to transport files to and from school |
| Teacher webpages | • Are available for all teachers | • Not easy to navigate and not up to date |
Conclusion

I embarked on this study to find out from the students how they use technology for powerful learning inside and outside of school. This chapter has presented the results gleaned from the data gathered during the interviews and focus groups. I found that the students were independent learners who figured out how to use software and new technology by trial and error. Three primary themes emerged from the analysis of the interview and focus group data: (1) technology fosters independent and interdependent learning, (2) teacher skills and comfort with technology make a difference, and (3) access to technology impacts opportunities for powerful learning.

The first primary theme that emerged during the analysis of the interview and focus group data was that technology fosters independent and interdependent learning. When the students became frustrated about not knowing how to use a particular technology tool, their frustration drove them to learn in powerful ways. Students used electronic devices, such as the cell phone, for their convenience as learning tools. The phone was one of the most frequently mentioned communication/collaboration tools. The phones were handheld computers for students, serving as inquiry devices used to gain knowledge by texting friends or posting questions on Facebook to request help with learning. Students used phone cameras to capture homework assignments, classroom notes, and pages from their textbooks.

The students gave specific examples of their independent learning experiences. The software students used in their technical programs required a high level of skill. The complexity of the software led students to seek out alternate ways to learn. They searched for training materials online, where they found YouTube videos and PowerPoint
presentations to give them the practical knowledge they needed to use the software successfully. To build their skills, students wanted access at home to the software programs they used in their technical programs.

The second primary theme that emerged from the analysis of the interview and focus group data was that teacher skills and comfort with technology make a difference. The first subtheme was that students appreciate it when their teachers integrate technology into their learning. Students appreciate the knowledge of their classroom teachers in their quest for powerful learning. Students complimented their teachers for helping them learn how to use complex software. Students appreciated the teachers who shared their PowerPoint presentations online for students to review later. Powerful learning was possible when teachers shared websites with students to use outside of class to help them gain a deeper understanding of concepts and for review and practice.

The second subtheme was that instructor reticence about technology tends to backfire. Students were frustrated about some teachers’ lack of technical skill. Students recommended professional development for their teachers to build their technology skills. The students wanted to use the iPads more and cited the teachers’ lack of knowledge about iPads as the reason they were not used more often.

The third subtheme is that students do not want to be responsible for teaching teachers about technology. Students were happy to teach each other and their parents how to use new technology but did not volunteer to teach their instructors technology skills. Whereas the students learned technology skills by trial and error, they believed their teachers required formal professional development to build their skills. Although the
students felt they had more technology skills than some teachers did, they suggested teachers learn technology skills from others.

The third primary theme that emerged from the study was that access to technology impacts opportunities for powerful learning. The students were disappointed that they could not use their phones more. School officials allowed phone use as a learning tool and then later curtailed the practice. Some teachers continued to allow phone use and the students found that it helped with learning.

The students voiced their complaints about the school’s Internet filter. Repeatedly, students pointed out that the school Internet content filter was a roadblock for students doing research. For unknown reasons, links were blocked when students were trying to do a project. The students used YouTube for powerful learning all the time, and the school’s content filter blocked YouTube. To have more opportunities for powerful learning, students wanted less restrictive Internet filtering at school.

In conclusion, the results of this study show specific areas where education practices can be changed to improve the infusion of technology into teaching and learning and, in turn, improve student skills and knowledge. The student voice provided a realistic viewpoint of what was happening for these students with technology in their learning activities. The open, honest feedback from the students generated data that led to the findings discussed in Chapter V.
Chapter V:

Discussion of Research Findings

Introduction

As the director of technology in a vocational-technical high school, I designed this study to address the problem of practice of what it looks like when students are using technology for powerful learning. This issue matters because to succeed in college and careers and be contributing members of society, it is critical that students become proficient users of technology (Darling-Hammond, 2008). Students gain “vital media literacies” and build 21st-century skills using technology tools for powerful learning (Darling-Hammond, 2008), and technology tools create opportunities for higher-level thinking and collaboration (Bellanca & Brandt, 2010). I explored the literature in the areas of teaching and learning practices that build technology competence, how technology is used in the classroom, and how to change outdated classroom practices to integrate technology. My investigation of the existing literature, combined with the problem of practice that I identified, led me to ask the following question: *In what ways have students experienced the use of technology tools for engaging in powerful learning experiences during the school day and outside of school?*

In my role, I am responsible for integrating information and communication technology (ICT) literacy competencies into the academic and technical curriculum. My purpose in starting this research was to investigate how students engage in powerful learning experiences using technology at school and at home and consequently build their ICT literacy. By uncovering what the students are actually doing, I can transfer this knowledge into designing staff development to prepare teachers to integrate technology
more effectively into instruction. This training for staff will support improved technology integration and powerful learning opportunities for students that will simultaneously build their digital skills.

In this qualitative study, I wanted to hear directly from the students about their experiences with technology. The study site was a public regional vocational-technical high school located in a suburban area of Massachusetts, and the 16 student participants were seniors from the TV media/theater arts (TVM) program or the design and visual communications (DV) program. Data were collected through five individual interviews and two focus groups, which provided rich information for closing the gap between what students know about and practice daily with technology and the classroom practices that have not really changed much since the 1800s (Jacobs, 2010). There is abundant literature from the perspective of practitioners using technology in the classroom; however, there is a dearth of literature incorporating student voices and perspectives about this same phenomenon. This group of students described what motivates them to learn and how they effectively use technology in the process. The student voices captured in this study provide valuable insight that can ultimately help us improve teaching and learning.

This chapter begins with a discussion of the major findings, connecting them with themes in the literature review and theoretical framework. This is followed by sections on recommendations, the significance of the study, limitations, validity, and future research. The chapter closes with conclusions.
Discussion of Major Findings

The focus of the study was to determine how students are using technology for powerful learning so as to identify best practices and areas for improvement. The themes that emerged in Chapter IV are the basis for the findings in this chapter. The data provided by the participants presented the student view of what is transpiring in students’ lives with technology and how they learn in powerful ways with the online resources and technology tools now available to them. Students are already using technology in creative ways for learning. Incorporating these practices into instruction will promote school improvement in integrating technology into teaching and learning. After thoroughly reviewing and analyzing the data in light of the existing literature and the conceptual framework, three primary findings emerged:

1. Technology is more effective when infused into instruction for learning than when used as an isolated tool.

2. Access to technology impacts access to knowledge and learning.

3. Differential access to technology has social equity and justice implications.

Finding 1: Technology is more effective when infused into instruction for learning than when used as an isolated tool. Students use online technology resources for learning independently and interdependently. Another way students learn is by using technology tools to communicate and collaborate. Online theory and connectivism theory, a subtheory of online theory, provide a lens for examining student use of technology tools for learning.
Online theory is the first theory that allows us to view the educational benefits of the Internet with the capabilities now available for communication and research (Anderson & Elloumi, 2004). Connectivism, a subtheory of online theory, focuses on the interrelationship between learning and the technological tools now available in our society (Strong & Hutchins, 2009). A component of online theory was influenced by educational theorist Lev Vygotsky’s zone of proximal development (ZPD) (Miller, 2002), which is the learner’s current level of ability compared with his or her potential for learning when provided with more knowledgeable others (MKOs) (Anderson, 2008). Using the resources of the Internet, learners collaborate online and increase their knowledge (Anderson & Elloumi, 2004, p. 37; Miller, 2002, p. 257). Among the researchers in online education, Mohammed Ally has cited many advantages of online learning, such as access to “experts” in specialized fields and a convenient opportunity for tutoring (Anderson, 2008, p. 17).

**Building knowledge and skills.** The students in the study revealed that they used online resources to learn on their own. They gave examples of using technology to complete projects and discussed their challenges when they did not know how to use a technology tool, such as software, to complete a project. When this happened, their current level of knowledge, or competence at using the software, was not at the level needed to complete the task without access to a tutor (MKO) or other resource to help fill in this knowledge gap (Anderson, 2008). When students wanted to learn more about a specific topic, they searched online for tutorials created by experts, or MKOs. The classroom teacher no longer has to be the only MKO; access to online resources brings
multiple online MKOs into the classroom. Students find MKOs to build on their current level of knowledge (ZPD), and they do this independently as suggested by online theory (Anderson, 2008). Kent provided an explanation for this process. He stated, “[If] I don’t exactly understand [how to do something], I will try to find a video tutorial [online].”

The Web 2.0 tools now available allow students access to a large number of people for “feedback or support” (Greenhow et al., 2009, p. 249). With the availability of all the online resources, the role of the classroom teacher can shift into the role of a coach or facilitator (Bellanca & Brandt, 2010). In this role, the teacher can focus on achieving learning goals and monitoring student-learning outcomes.

**Process of online learning.** In this study, students learned with technology by searching for online tutorials (Anderson, 2008). When learning online, students described the process they followed to answer their questions (Greenhow et al., 2009) (see Figure 2). First, students became frustrated while trying to complete an assignment or project. Second, they identified the problem. Third, they decided whom they would ask for help, whom the MKO would be (Miller, 2002). Fourth, they formulated a question and posed their question to the MKO. If they did not receive the response they needed, they refined their question until they received relevant feedback.
Figure 2. The process of student learning by using technology tools to communicate and collaborate. Students become frustrated when they are challenged by a question they cannot answer. They follow this process by formulating a question, seeking out a resource to answer the question, and asking and refining the question, and this process leads to learning.

With the technology tools now available, there is much more opportunity for collaborating and exchanging ideas (Greenhow et al., 2009, p. 249). There were no references in the study about structured online collaboration between students and their classroom teachers; however, students do this on their own with social networking to exchange information in their personal lives all the time (Anderson & Elloumi, 2004; Bellanca & Brandt, 2010). The educational benefits of the Internet influence communication, collaboration, and research (Anderson & Elloumi, 2004). This point is supported with all the examples students provided about using communication/collaboration tools to build their knowledge and skills. Students described collaborative learning experiences with their peers face to face or remotely, reporting that they had learned from and taught others (Greenhow et al., 2009). For example, after the technical
program instructor taught the DV theory lesson, Gina taught her friend the theory lesson again. Mary Skyped with and texted college friends to obtain math tutoring. Maria, Gina, and Mandy taught family members how to text, use Facebook, and use Microsoft Word. Students have the capacity to collaborate with each other, and there are many more resources available to them to explore and build their knowledge and understanding (Anderson, 2008).

Students take advantage of all the technology resources available without any formal training on how to use the technology for powerful learning. A study by Katyal and Evers (2004) reported that students’ “autonomous self-learning that takes place outside of school was seen as more authentic to the lives of students” (p. 380). Students in this study had the ability to locate online learning resources by articulating their search terms specifically enough to generate links relevant to the content they needed. These students mastered how to use online resources for learning. This resonates with the meaning of powerful learning, with its practicality and the level of challenge required to design the search accurately for valid results (Rivera & Rowland, 2008). The learning is practical for students who might not have access to their classroom teacher at the time they are looking for information. This process is challenging if the students are looking for specific training, such as how to use a software tool properly to complete a project. When students find the training they need, this demonstrates skill at “information literacy” (Bellanca & Brandt, 2010, chap. 3, para. 17). This skill is evidenced by the students exploring the resources available on the World Wide Web to find the exact resource needed to solve the problem. This finding supports the drive to infuse technology into instruction for learning instead of using technology as an isolated tool. In
this process, the learning objectives are achieved by student independent problem solving. The student starts with a question, seeks a source of information, asks and refines the question, and finally experiences true learning.

Motivation for learning and technology. Being self-motivated increases students’ capacity for learning (Pink, 2009). The examples students provided about their learning align with the qualities of powerful learning. One example is students’ searching for tutorials to help them master particular skills (Rivera & Rowland, 2008). Similarly, learning engages students and keeps them interested when they are able to design their own projects using technology (Pink, 2009; Rivera & Rowland, 2008). A critical 21st-century skill is “demonstrating personal responsibility for lifelong learning” (Bellanca & Brandt, 2010, chap. 3, para. 25). The students demonstrated this skill by giving many examples of learning on their own. Ultimately, the processes of learning powerfully with technology and learning technology through other powerful learning pursuits are simpatico. A study by PBS Learning Media agrees that using technology tools in education helps to “motivate” students to learn, with 74% of teachers responding affirmatively to this survey question (Hanover Research, 2013, p. 8).

Formal training. The students in this study did not receive any formal training on using the Internet or communication and collaboration tools at the high school. The findings in this study challenge the results of studies that reveal students need direct instruction on how to use technology tools to become skillful. The study of London et al. (2010) revealed the need for technology centers to provide students with structured use of technology tools to develop their skills. Similarly, Zhao et al. (2010) found that online access without formal training on search techniques and research methods would not help
to improve Internet self-efficacy. While the studies reported that a certain amount of technology skill instruction was necessary to prepare students to use technology in pursuit of powerful learning, participants in this study reported using a variety of digital tools on their own to learn and to reinforce learning. While direct instruction did take place for students to learn particular skills, such as how to use the complicated software in their technical programs, the findings in this study suggest that when students are using technology for powerful learning they are building their own skills in the process. When challenged by a concept or software tool, students used online resources to find ways to learn more. The students did this on their own without teacher intervention (Bellanca & Brandt, 2010).

**Teacher’s role.** It is important to point out the teacher’s role in the new frontier of student learning in this digital age. When students learn independently using technology tools, this does not supplant the classroom teacher. If the students’ technical or academic instructors were not available when they encountered a problem, students looked for online tutorials (Anderson, 2008). Online learning and use of technology tools to collaborate with others for learning complements the classroom instructor (Bellanca & Brandt, 2010). A study by Ertmer et al. (2012) found that administrators are encouraging teachers to promote student “self-directed learning” to supplement classroom instruction (p. 433). Students were appreciative of the instructors who provided them with websites to reinforce their academic instruction outside of class. For example, Mary was grateful her biology teacher provided a list of websites for students to use to supplement their classroom instruction because it helped her understand difficult concepts. For Gina who found a tutorial on YouTube to learn more about Photoshop, her technical program
Gina was building on the prior knowledge gained from her teacher’s instruction. In the next section, this idea of technology complementing teacher instruction is discussed in more detail.

**Finding 2: Access to technology impacts access to knowledge and learning.**

This section expands on the finding that student access to technology as influenced by the classroom instructor and student practices has an impact on access to knowledge and learning. The study revealed that teachers who are technologically inexperienced and/or reluctant about using technology for teaching and learning can sometimes prevent student access to knowledge and learning. These teachers’ practices were at odds with the students’ practices of using technology regularly for learning from and with each other.

The lens of online theory provides a filter to uncover educational practices requiring modifications to integrate technology into teaching and learning (Anderson, 2008). This theory indicates that experiences of online learning provide students with the opportunity to build on their current knowledge through collaboration with peers and concurrent support from the instructor as an MKO (Anderson & Elloumi, 2004).

**Effect of teacher inexperience and reluctance on technology integration.** A review of the literature revealed a need to change teaching practices to align with the use of digital tools (Kopyc, 2006). The successful integration of information technology into instruction will involve vast changes in teaching practice (Boitshwarelo, 2011). Kopyc (2006) cited the low number of instructors actually using technology effectively to enhance teaching and learning. The findings of the study demonstrate that some teachers are reluctant and inexperienced with using technology in the classroom. Teachers may not be technically savvy enough to design lessons that allow students to use computers as
a learning tool (Rentie, 2008). A study by Ertmer et al. (2012) revealed that teachers inhibit the integration of technology with “attitudes and beliefs” that reflect their fears about using technology in the classroom (p. 434).

Neither academic nor technical programs have really changed to incorporate the use of different technology tools for powerful learning (Kopyc, 2006). As evidenced by students’ daily use of computers in technical programs, technology was integrated into the technical programs; however, students did not report using a variety of digital tools in their academic classes or nontechnical aspects of their technical program classes. For example, students complained that they did not get to use the iPads much because some of their teachers did not know how to use them or know how to integrate iPad use into instruction.

**Teachers, technology use, and motivation.** Students in this study expressed their enthusiasm about using technology for learning and were frustrated when teachers showed reluctance about using technology. Wendy pointed out, “Kids like technology. Kids find technology interesting.” In a study by Zhao et al. (2010), high school students were found to enjoy using the Internet for learning when they could do so with their friends (p. 348). In contrast to what students are found to enjoy, students in this particular study felt that some of their instructors did not want to integrate technology. As an example, some teachers encouraged students to use printed books as references instead of online resources. Students believed these teachers were not comfortable with the students’ skill at validating online sources.

There is a plethora of technology available for student learning. As demonstrated in the results of this study, students are excited about using technology for learning, and
using technology motivates them to learn more (Hanover Research, 2013, p. 8). Students expect to use technology for learning (Waycott et al., 2010). In this study, students used computers daily in their technical programs to learn the skills associated with the particular trades they were studying. They reported using few other specific technologies during their academic and technical program courses that enhanced their learning. Rather, students expressed their dislike for technology-based lessons that were not challenging to them, emphasizing their preference for learning about and with the tools that allowed them greater degrees of creativity and deeper engagement. If computers are used for drill and practice, this will not provide the powerful learning experience students need to build their skills in higher-level problem solving (Rentie, 2008). With the exception of computers, other technology tools available for learning, such as collaboration tools, were not typically incorporated into daily instruction in academic and technical courses as reported by the students in this study. Without the full integration of technology into instruction, students are missing powerful learning opportunities. Integration of technology is said to lead to increased academic achievement (Metiri Group, 2009).

Culture shift: Learning from and with each other. As the study revealed, in addition to learning from their classroom instructor, students use technology to learn on their own and with their peers. To support this change in student learning, teachers can adapt their practices. Student independent learning allows teachers more time to develop new instructional materials (Bellanca & Brandt, 2010). Additionally, students can use their technology skills to collaborate with other students and teachers to integrate technology into learning. This practice aligns with the concept of building on current knowledge by accessing an MKO to reach a higher level of knowledge (Anderson, 2008).
Some instructors were reported as reluctant or inexperienced with technology. Technology tools “motivate students to learn” as seen in the report, “Technology Integration Frameworks for the K-12 Curriculum” (Hanover Research, 2013, p. 8). This represents a change in the traditional ways students learn and is known as “self-directed learning” (Bellanca & Brant, 2010, chap. 4, para. 20). This practice can be encouraged in the classroom to change teaching and learning practices to align with 21st-century skills (Bellanca & Brant, 2010). Technology can be used as a tool for independent, creative learning. In addition, students have the opportunity to practice collaborative learning. Therefore, as all the literature suggests, learning can be enhanced and facilitated to great effect with technology.

Integrating technology into instruction involves supporting teachers who are learning how to use technology and helping them select appropriate technology tools for the content students need to learn (Bellanca & Brandt, 2010). When students are engaged to collaborate with teachers on technology, this is a culture shift for everybody to learn together. Self-directed or independent and interdependent learning is possible because students are adept with technology. This represents a change in school culture. This culture shift moves from the teacher as all-knowing to the teacher as the facilitator and learning coach, giving students learning direction (Bellanca & Brant, 2010, chap. 12, para. 27; chap. 10, para. 39). The teacher’s responsibility shifts to supporting students to become “self-directed and interdependent” (Bellanca & Brant, 2010, chap. 12, para. 27). Students engage in collaboration with teachers and their peers to build knowledge.

According to Anderson (2008), Vygotsky’s work influenced the online theory of connectivism and the advantages of digital learning with the availability of web-based
activities. Study participants reported using the following web tools for independent and interdependent learning: YouTube, blogs, wikis, Facebook, Tumblr, Twitter, and Google. One student described how she created a PowerPoint presentation using YouTube video clips to teach her classmates about spoken word poetry. Students provided many examples of using online tutorials to learn how to use software or understand concepts in math or their technical programs.

With all the technology available now, students have different options for learning than in the past and do not necessarily need teachers in the classroom in the same way they did prior to having access to technology resources (Rosen et al., 2010, p. 50). The hierarchy of learning has changed with students learning on their own; walls are broken down when students learn independently and with each other. Fostering students’ capability as independent learners by embracing students’ knowledge about using technology tools for learning requires changing the school culture. There was minimal evidence of teachers learning from students about technology in this study. For example, when students used iPads, they resented spending class time teaching the teachers how to use the devices instead of focusing on learning their subject. Changing the culture of schools toward integrating more self-directed learning that recognizes the students’ expertise will allow students to collaborate with teachers (Bellanca & Brandt, 2010). Research shows that administrators are also encouraging teachers to promote student independent learning to supplement class instruction (Ertmer et al., 2012). Students have the skills to be the MKOs in the classroom with their technology skills. Having students use their technology skills to collaborate with their instructors is a beneficial cultural shift in instruction that will take time and training to implement.
**Finding 3: Differential access to technology has social equity and justice**

**implications.** Students who have access to technology are empowered; students without this access are disempowered (Darder & Torres, 2003). The study allowed students to tell their stories about access, or lack of access, to technology and how that impacted learning (Banister & Fischer, 2010). The findings can be investigated using critical theory as a lens. Critical theory provides a means to uncover inequities in power and remove its influence in education (Darder & Torres, 2003). By using critical theory to identify issues of social equity and justice, remedies to oppression and power inequity can be designed to alleviate oppression and lead to emancipation.

**Cell phone policy.** The finding about the school restriction on cell phones for learning points to social justice and equity (Darder & Torres, 2003; Kopyc, 2006; Rentie, 2008). Students use technology tools, such as their cell phones, outside of school continuously (Bellanca & Brandt, 2010; Levinson, 2013). As informed by the literature and the findings of this study, cell phones are at the top of the list of technology tools used by students. The student handbook for the school in this study indicated that cell phones could not be used during the school day in any school location. Students were frustrated that they were not allowed to use cell phones at school for learning. This represents an example of social inequity (Darder & Torres, 2003). When students do not have access to cell phones for learning in class, they are restricted from using a tool now available in our culture. Students who cannot afford cell phones miss the opportunity to work collaboratively in class with friends who have cell phones and thus to participate in learning by using the cell phone as a tool (Darder & Torres, 2003). These students who do not have access to technology outside of school benefit from technology integration at
school. The affluent students have access at home to the knowledge and skills available with access to technology; the poor students do not.

**Blocked access.** Blocked access to online resources was a finding of the study. The school’s policy for Internet content filtering denies students access to resources for knowledge and learning. The social impact of power and privilege is exacerbated when the school’s Internet content filter policy impedes student learning (Darder & Torres, 2003). Kincheloe (2004) suggested that one example of power inequity, as described by Paulo Friere, is the disparity in the availability of knowledge and power in the 21st century. According to Kincheloe, Friere stressed the direct connection of a just society and the education of youth to become both knowledgeable and skillful. The Internet filter blocking students from meaningful learning focuses on this point. The Internet filter blocks students from accessing online learning content such as blogs, email, Google docs, YouTube, and online articles. The librarian had to download articles for students that were blocked by the Internet content filter. Students with Internet access on their smart phones or Internet access at home can use these other methods to gain access to some content that is blocked at school. Students without smart phones or Internet access at home are educationally disadvantaged when they do not have access to online learning content during the school day.

**Home technology access.** The participants reported the benefit of having home access to the software used in their technical programs to continue building their skills after school. Some of the students cannot afford to buy the software or a powerful computer to run the software, creating social inequity (Darder & Torres, 2003). The digital divide exists for students who cannot access the same software and tools they use
in school when they are at home (Fitch, 2006). The study by London et al. (2010) revealed that one method of bridging the digital divide is by providing supplemental access to technology after the school day at community technology centers. Providing supplemental access as a remedy for students who are negatively impacted by differential access to technology resonates with these findings. At the school where this study took place, there is currently no plan for providing supplementary access for students who do not have adequate access to technology tools for knowledge and learning at home or during their school classes. The qualitative study by Fairlie et al. (2010) revealed that students with home computers were 6% to 8% more likely to graduate from high school. This supports the positive influence of technology on student success.

**Technology integration at school.** Students without access to technology are prevented from building knowledge and skills (Banister & Fischer, 2010). Teacher pedagogy and technology competence impact the use of digital tools in the classroom (Burniske, 2008). An obstacle to knowledge and learning is lack of access to technology integration at school that deprives students of powerful learning experiences to build their knowledge and learning (Rivera & Rowland, 2008). This is a form of social justice inequity and oppression for the students who have access to technology neither in the home nor at school (Darder & Torres, 2003; Kincheloe, 2004). A change in classroom practices to integrate technology into the learning process will help to mitigate the impact of variable access (Rothman, 2006; Borja, 2008).

The findings revealed how students use technology effectively for learning and suggest ways to alter classroom practices to incorporate technology into instruction for powerful learning. Using online resources, students build their knowledge and skills by
learning independently. Through online communication and collaboration, students access others with more expertise when they face challenges in learning. Student independent learning can be used to support classroom instruction and allow instructors to become facilitators of learning. This cultural shift in teaching and learning will require time and training for successful integration. Students who do not have access to technology tools, such as cell phones or expensive software tools, at home to support their learning are negatively impacted by missing out on learning experiences. By integrating more technology into classroom instruction, students without access to technology at home will benefit by building their knowledge and skills while at school.

Recommendations

During this journey of scholarship, my professional and personal goals changed. Initially, I believed that my role as an administrator overseeing all the school’s technology was to teach teachers how to use technology for instruction. After the scholarly review of the literature, collection of data from students, and analysis of the data, I have a deeper understanding of teachers and how their roles have changed with the infusion of technology into society. When I taught computer applications and computer literacy 20 years ago, I knew as much as or more than my students did. This is no longer true. Now the students know more than their teachers and I do about some facets of technology. This is unnerving. I understand how classroom teachers feel. I feel the same way. How do I perform my job responsibilities as the technology leader of the school if the students know more than I do about some technology tools?

My goal after completing this research is to support the teachers while they infuse technology into their lessons by using the findings for direction. I will ask the teachers
about their learning objectives. Then, we will collaborate with students to find the best method for students to learn the content. The students learn by taking risks and trying out the tools to find the one that works best for them. The students learn by seeking out MKOs online. I recommend more support for the teachers through professional development to help them create opportunities to use technology for achieving learning objectives. We all must work to become more comfortable with all the technical tools available and find those that correlate with the learning objectives in the classroom. We need to seek out MKOs in our school and learn from them and share their successes. We need to cheer ourselves on when we experience technology successes and gear up for problem solving when we face technology obstacles.

Positive findings from the study were the students’ independent learning examples and technology skills. An area for improvement is increasing students’ access to technology tools and resources to allow powerful learning. The findings show that instructors need more training to learn how to infuse technology into learning. As the director of technology, I am responsible for ensuring student access to technology tools and resources; this includes adequately preparing the teaching staff to infuse technology into the curriculum.

By identifying the findings, I can now make recommendations for correcting some of the inadequacies revealed about student access to technology. First, the Internet filter must be reconfigured to unblock valuable learning resources for students. The frustration about blocked Internet sites was a prevalent comment throughout the study. Second, the lack of access by staff and students to any collaboration tools for instruction needs to be remedied. I will build a technology curriculum for teachers about how to
facilitate online collaboration in their classrooms to increase student and teacher collaboration for learning; online collaboration helps learners become more knowledgeable (Anderson & Elloumi, 2004). Third, student access to technology must be addressed. At the site school, there is currently no plan for providing supplementary access for students who do not have adequate access to technology tools for knowledge and learning at home or during their school classes. Fourth, the teaching staff requires support to learn how to infuse technology into daily classroom activities. Training staff on how to use online collaboration tools will support staff technology skill building. With a plan to provide professional development to instructors about online collaboration tools, students and staff will have the opportunity to communicate with email and share documents online for collaboration.

To achieve the goal of professional development for staff integration of technology into the curriculum, I recommend using the professional learning community (PLC) at our school. Four years ago, PLCs were introduced to support staff collaboration for raising student achievement and increasing academic rigor. The culture change of infusing technology into instruction must be supported and nurtured by different professional development approaches like building PLCs (Bellanca & Brandt, 2010, chap. 4, para. 2). PLCs promote collaboration and sharing among educators. The PLC approach, a team of educators working together cooperatively, would be compatible with the work of increasing the use of technology toward powerful learning because of the collaborative nature of both ventures. Not only will the faculty strengthen the learning community at the school, but the staff will learn how to use collaborative technology tools to communicate and collaborate in the process. The staff will gain practical
experience using technology by communicating and collaborating about teaching and learning with technology while participating in the PLC.

Finally, with the knowledge about students’ capabilities for independent and interdependent learning, I propose that students become involved in technology collaboration with our staff, making a valuable technology resource available. I plan to design technology professional development for staff and students to train students to act as technology collaborators and staff on how to utilize this resource optimally in their classrooms.

Collaboration between students and teachers will allow everyone to become more involved in the culture shift to integrate technology into instruction. I will help teachers find out what the student learning objectives are and how to determine the best technology tools for the task. I will share with staff the student process for online learning displayed in Figure 2. I will follow this model myself and have teachers practice this process during professional development.

**Significance of the Study**

Not all students have access to digital technology during and after school to learn powerfully with technology and build and sustain their digital practice. Students have access to technology tools during the school day; however, they may not be using the technology optimally to build their digital skills.

The problem of practice was whether all students are using technology for powerful learning and building their digital skills during the school day and outside of school. The significance of the problem is demonstrated when students do not have access to technology tools. The students who do not have access to technology tools lack
valuable learning experiences to build their skills. Preparation of a competitive, highly trained workforce is jeopardized if 21st-century skills that are so vital for a student’s future success are not available to students.

Digital learning is still evolving in K-12 education in the United States (Jung & Lim, 2009). The educational problem of all students having access to opportunities for digital learning outside of the classroom is significant for different educational stakeholders. First, student access to digital learning tools outside of school involves a change in student learning and teacher practice (Rothman, 2006). For successful integration of digital access for all students, adequate preparation is essential for stakeholders, including teachers, students, parents, school boards, and administrators, along with the curriculum and technology departments (Surdin, 2009).

Limitations

The results in this study are unique to the setting of the data gathering, which limits the ability to generalize the findings. The data collected from interviews and focus groups provided the student voice of 16 students, 4 males and 12 females, in a public vocational-technical high school located in Massachusetts. The findings cannot be generalized to other school settings, such as a traditional academic high school. In addition, the higher number of female participants might have influenced the findings. There are many influences to student technology use for powerful learning. The two technical programs chosen to participate in this study were selected based on the students’ ability to communicate freely with me about their technology needs and experiences. These students use technology regularly during their technical programs, where they use complex software to complete their assigned projects. Their experiences
with digital tools cannot be generalized to all high school students. I have attempted to provide a thorough description of the context of the research and the data and analysis so readers can determine if the study’s findings apply to their setting (Merriam, 2009; Fraenkel & Wallen, 2009).

Validity

As discussed in detail in Chapter III, several approaches were employed to ensure this study’s validity—in terms of its credibility, transferability, and dependability (Lincoln & Guba, 1985). The student participants performed a member check of the transcripts and draft findings; findings were triangulated from different sources, including semistructured interviews and focus group discussions; reflective memos were used to promote continual reflection on the data and detail the evolution of the final analysis; thick descriptions were used so readers could judge transferability; and an audit trail was maintained. Finally, to reduce bias, I was mindful of my personal perspectives and continually worked to include the participant voices on their own terms.

Future Research

The results of the study revealed areas for future research. As a follow up to this study, I recommend including students, parents, teachers, and administrators at the school level and from other similar schools, particularly schools with an embedded technology curriculum, to investigate powerful learning with technology. Future study is needed to determine other influences, such as teacher pedagogy, on student technology competence. This research would support change in outdated classroom practices to integrate technology into teaching and learning, changing the mindset of classroom teachers as all-
knowing to their new role as coaches and facilitators. The results of the research can be used to design staff training to build their skill level in delivering instruction that fully integrates technology into the curriculum. The data can be used to establish training goals with specific outcomes linked to areas needing improvement.

I recommend future research to identify areas of technology skill strength and weakness for staff and students. A similar study comprising a greater number of participants may reveal data that is more detailed to use for educational change. Asking participants to respond to questions focusing on information and communication literacy standards will capture data from critical stakeholders to use for improving education. To strengthen the information and communication literacy competence of staff and students, school officials can use the findings to develop specific, measurable goals and objectives for improvement.

Finally, I recommend future study focusing on the use of Internet content filtering in high schools. Internet content filtering is required for schools that receive discounts on Internet service through the Schools and Libraries E-rate program. A study to investigate how different districts comply with the filtering requirement would be useful to high schools. The persistent comments from students in the study about the content filter restricting online learning demonstrate the importance of such a study.

Conclusions

As the director of technology in a vocational-technical high school that focuses on career readiness training, this doctoral thesis provided me with new insights to share for school improvement and to celebrate the successes identified. This study included the voice of 16 vocational-technical high school students in Massachusetts. I view the results
as positive for improving teaching and learning to incorporate more powerful learning with technology into instruction. The students described their experiences with technology, which led to recommendations for change in educational practices in our school. Other schools may want to consider the findings in their own improvement work. The study results tell us where we are now with technology for powerful learning according to the students’ perspective, enabling us to set measurable goals and objectives to achieve greater integration of technology.

The findings cited areas for improvement. Change is warranted to make the Internet content filter less restrictive and allow students greater access to online resources for learning. In doing this, we will increase students’ ability to attain 21st-century media literacy skills. For students who do not have access to software, computers, and the Internet at home, this inequity will need to be addressed to provide all students access to the learning tools they need for success.

The staff requires additional professional development to build their technology skills. The technology-savvy students have the capacity to collaborate with instructors to support the infusion of technology into the curriculum. The student capacity for self-directed learning can be useful for freeing up teachers to act as facilitators and coaches and give teachers extra time to create more technology-rich lessons.

Data from this study support the need to increase use of collaborative tools in the classroom. This supports the initiative of implementing a technology curriculum for online collaboration. Implementing a technology curriculum is a practical first step to start changing the school culture to integrate technology fully. This study prepared me to support teachers and students with the integration of technology into instruction to ensure
students are using technology to learn in powerful ways to build and refine their 21st-century skills.
References


Appendix A:

Interview Protocol

Before beginning the interview, I will explain to the students what powerful learning is. I will also create a poster with the list of characteristics and refer the students to that list.

**Powerful learning for a student:**
- Is interesting and makes the student want to become really involved
- Is enjoyable, fun, exciting
- Involves solving a problem
- Connects with something the student already knows
- Is an individual or group project where students learn from each other
- Is useful; what is learned can be used in another way for another project
- Is important, means something
- Is guided by teachers
- Is controlled by the student or students
- Involves students finding answers on their own
- Involves experts helping students learn something new
- Is practical, learning that can be used again and again in the real world
- Is realistic, not fake; it connects with real life in some way
- Does not feel like work; the time goes by without noticing
- Is not too easy; it causes the student to want to figure things out
- Is not boring
- Involves researching on the Internet and deciding whether or not information found is true or not
- Involves students evaluating their work
- Involves taking risks, making mistakes, and learning from them
- Is learning that is not forgotten

**Semistructured interview questions:**
1. What does a powerful learning experience using technology mean for you?
2. Describe any experiences you had in using technology tools (phone, software, Internet, email, blog, wiki, Facebook, etc.) for powerful learning experience(s) in school and/or outside of school.
3. If given the opportunity to use technology for powerful learning projects for school, what software, equipment, and access would you want to use?
4. What do you think may encourage students to use technology for powerful learning experiences?
5. What do you think may discourage students from using technology tools for powerful learning experiences?
Appendix B: Consent Form

Northeastern

Notification of IRB Action

Date: September 13, 2012  IRB #: 12-07-03

Principal Investigator(s):  Jane Lohmann
                          Carol Heidenrich

Department:  College of Professional Studies/Education

Address:  25 Nightingale
          Northeastern University

Title of Project:  Student Technology Use for Powerful Learning

Participating Sites:  [Blank]

Informed Consent:  One (1) signed consent form for Parents and Minors

This project is being approved under 46.404 which applies to children as research subjects and involves research not involving greater than minimal risk. Adequate provisions are made for soliciting the assent of the children and the permission of their parents or guardians, as set forth in 46.408.

DHHS Review Category:  Expedited #6, #7

Monitoring Interval:  12 months

Approval Expiration Date: SEPTEMBER 12, 2013

Investigator’s Responsibilities:

1. Informed consent form bearing the IRB approval stamp must be used when recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

C. Randall Colvin Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #: 4630
Research Study about Student Use of Technology for Powerful Learning


Who?

I am asking the students in Design and Visual Communications and TV Media/Theater Arts to participate in a study about student use of technology for learning. Students in your program use technology tools every day. You use technology outside of school too, such as computers and phones. The projects you complete for your program show examples of the different technology skills you learn.

What?

This is a research study to gather information about how students use technology to build their skills and knowledge. Your feedback is valuable for improving education. The information you share will be used to improve schools. I will ask you some questions about technology use. There are no wrong answers.

I appreciate your participation. You will receive a $15 Amazon gift certificate for participating.

When?

I plan to conduct the study during the school day. To find out information about your technology use, I will ask you to participate in an interview or group discussion. The interviews and discussion group will last about 45 minutes. I will interview five students individually about technology use. The information will be used to create questions for the group discussions. Three different groups of five students will participate in the group discussions. I will notify you in advance to let you know when the interview or discussion group is scheduled. I will work with your teachers to schedule the interviews and discussion groups at convenient times for you.

Where?

I will conduct the interviews and discussion groups in the Library conference room.

Why?

I am a student in the Professional Studies program at Northeastern University in Boston, MA. I decided to have students from your technical program participate in this study for my doctoral research project. For success in the 21st century, students need to become skilled users of technology. Students in your program are skilled users of technology. When you share information about how you use technology for learning, this information can help to improve
learning for other students. I am in the process of completing a doctoral degree in Educational Leadership. This study is a part of the requirements for the doctoral dissertation I will write. The dissertation is like a book. It contains five chapters. One of the chapters will include the information you give me when you participate in the interview or discussion group. Then, the final chapter will be a report on the results of the study. I will write the report after I review all the information you provide about how you use technology for learning. The information you provide will be private, and I will not use your names at any time in the report.

You do not have to participate. If you decide to participate, you and your parents will need to sign a permission form.

Please let me know if you have any questions.

Carol Heidenrich
Northeastern University College of Professional Studies, Doctor of Education Program  
Investigator Name: Carol Heidenreich  
Title of Project: Student Technology Use for Powerful Learning

Informed Consent for Your Child to Participate in a Research Study

I am inviting your child to take part in a research study. This form will tell you about the study. You may contact me to ask me any questions that you have. When you are ready to make a decision, you may tell me if your child wants to participate or not. Your child does not have to participate if your child does not want to. If your child decides to participate, I will ask you to sign this statement and will give you a copy to keep; your child will also be asked to sign this Consent Form as well.

Why is my child being asked to take part in this research study?  
Your child is being asked to participate in this study because your child is enrolled in the Design and Visual or TV Media Theater program. The students in the program are being asked to participate because they have experience using technology tools for powerful learning based on the technology intensive program they are enrolled in at school.

Why is this research study being done?  
The purpose of this study is to inform schools about specific student experiences where technology is used for powerful learning. Powerful learning is defined as learning that is meaningful with special qualities that make it valuable (Rivera and Rowland, 2008). Some of the qualities include being practical, realistic, challenging, high quality, widely useful and appealing. An influential teacher may be involved in powerful learning experiences (2008).

What will my child be asked to do?  
If your child decides to take part in this study, I will ask your child to participate in an individual interview with questions about technology use that seven to eight students will be asked to take part in. The final activity your child may be asked to participate in will be a group discussion for four to five students about technology use for powerful learning. I will make an audio recording of the interviews and group discussions. After each interview and group discussion, I will type out all the information from the audio tape onto my computer.

Where will this take place and how much of my child's time will it take?  
The study will take place in the library. The interview will take 45 minutes. The group discussion will last about 45 minutes.

Will there be any risk or discomfort to my child?  
I do not foresee any risks or harm resulting from participation in this study.

Will my child benefit by being in this research?  
There will be no direct benefit to your child for taking part in the study. However, the information learned from this study may help schools to improve teaching and learning for students by identifying ways to build their technology skills.

Who will see the information about my child?  
Your child's identity as a participant in this study will not be known. Your child's part in this study will be confidential. Only the researcher on this study will see the information about your child. No reports or publications will use information that can identify your child in any way.

Procedures will be used to protect personal information. The data will be maintained on a password protected computer and the interview and group session recordings will be stored in a locked file cabinet in my home. The audio recordings will be destroyed after they are transcribed.
What will happen if my child suffers any harm from this research?
No harm is anticipated as a result of participation in this study.

Can I stop my child's participation in this study?
Your child's participation in this research is completely voluntary. Your child does not have to participate if your child does not want to. Even if your child begins the study, your child may quit at any time. If your child does not participate or if your child decides to quit, your child will not lose any rights, benefits, or services that your child would otherwise have as a student.

Who can I contact if I have questions or problems?
You may contact me, Carol Heidenreich:

You may contact my Advisor, Dr. Jane Lohmann:
Northeastern University
(617) 756.3237
J.Lohmann@neu.edu

Who can I contact about my rights as a participant?
If you have any questions about your rights as a participant, you may contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University Boston, MA 02115 tel. 617-373-7570, email: irb@neu.edu. You may call anonymously if you wish.

Will I be paid for my participation?
All students participating will receive a $15.00 Amazon gift certificate.

Will it cost anything for me (my child) to participate?
There are no costs anticipated as a result of participating in this study.

Is there anything else I need to know?
You must be at least 18 years old to participate unless your parent or guardian gives written permission.

I agree to [have my child] take part in this research

Signature of person [parent] agreeing to take part ____________________________________________________________________________ Date __________

Printed name of person above __________________________________________________________________________________________

Signature of person who explained the study to the participant above and obtained consent ____________________________________________________________________________ Date __________
Appendix C: Letter of Authorization from Superintendent

June 7, 2012

Nan C. Regina, Director
Human Subject Research Protection
960 Renaissance Park
Northeastern University
Boston, MA 02115-5000

Dear Ms. Regina:

Ms. Carol Heidenrich, Director of Technology, at ___________________________ has requested to conduct a study at the school. The study is a part of her doctoral research for Northeastern University and involves participation by high school students. The high school students will obtain written parental consent to participate in the study as indicated by the attached consent form.

It is my understanding that the purpose of the study will be to provide research data about student use of technology for powerful learning experiences. Students will participate in a survey, interview and focus group discussion as part of the study. The students will have the opportunity to opt out of the study at any time. Ms. Heidenrich has assured me that she will protect the confidentiality of the student data.

For the purpose of furthering study in the student use of technology for powerful learning, I authorize Ms. Heidenrich to conduct this study at ___________________________ All proper procedures for conducting studies of this nature are expected to be followed as required by the policies of ___________________________ and Northeastern University to protect the students involved in the study.

Please let me know if you need any additional information.

Sincerely,

__________________________

Attached: Student/Parent Consent Form

☐ Serving the towns

__________________________
## Appendix D: Dictionary of Technology Tools

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blog</td>
<td>Weblog; a newsletter on the Internet that is updated frequently (Fitch, 2006).</td>
</tr>
<tr>
<td>Chat</td>
<td>Online discussion or messaging with text over the Internet (Sabin, 2011).</td>
</tr>
<tr>
<td>Email</td>
<td>Transmitting a digital message over an Internet connection (Fitch, 2006).</td>
</tr>
<tr>
<td>Google</td>
<td>Search engine (<a href="http://www.netlingo.com/word/google.php">http://www.netlingo.com/word/google.php</a>).</td>
</tr>
<tr>
<td>Instagram</td>
<td>Photo-sharing application for phone (<a href="http://instagram.com/#">http://instagram.com/#</a>).</td>
</tr>
<tr>
<td>Phone</td>
<td>Cell phone or smartphone with data component for Internet access.</td>
</tr>
<tr>
<td>Text</td>
<td>Typing and sending a brief message, less than 160 characters, over a wireless network viewable over a handheld device, such as a cell phone (<a href="http://www.netlingo.com/dictionary/t.php">http://www.netlingo.com/dictionary/t.php</a>).</td>
</tr>
<tr>
<td>Tumblr</td>
<td>Web blogging site (<a href="https://www.tumblr.com/">https://www.tumblr.com/</a>).</td>
</tr>
<tr>
<td>Twitter</td>
<td>Free, real-time short messaging service delivering messages to computers and handheld devices (<a href="http://www.netlingo.com/dictionary/t.php">http://www.netlingo.com/dictionary/t.php</a>).</td>
</tr>
<tr>
<td>Wiki</td>
<td>Online space for working collaboratively on a document (<a href="http://www.netlingo.com/dictionary/w.php">http://www.netlingo.com/dictionary/w.php</a>).</td>
</tr>
<tr>
<td>YouTube</td>
<td>Website for uploading and sharing video clips over the Internet (<a href="http://www.netlingo.com/dictionary/y.php">http://www.netlingo.com/dictionary/y.php</a>).</td>
</tr>
</tbody>
</table>
Appendix E: Member Checking of Draft Chapter IV Data Findings

Member Checking of Draft Chapter 4 Data Findings

TV Media/Theater Arts

Review of Chapter 4 Draft

5/13/13
Date

05-13-13
Date

05-13-13
Date

05-13-13
Date

5/13/13
Date

5/13/13
Date

5/13/13
Date

5/13/13
Date

5/13/13
Date
Member Checking of Draft Chapter 4 Data Findings

Design and Visual Communications Students

Review of Chapter 4 Draft

5/13/13
Date

5/18/13
Date

5/13/13
Date

5/13/13
Date

5/13/13
Date

5-13-13
Date