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Digital Literacy and Career Capital:

How College Experiences are Preparing Students for the Transition to Work

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Education

by

Brit Astrid Toven-Lindsey

2017

ABSTRACT OF THE DISSERTATION

Digital Literacy and Career Capital:
How College Experiences are Preparing Students for the Transition to Work

by

Brit Astrid Toven-Lindsey

University of California Los Angeles, 2017

Professor Robert A. Rhoads, Co-Chair

Professor Mark Kevin Eagan, Co-Chair

Many students on college campuses today are members of the first generation to grow up surrounded by computers, the internet, and other information and communication technologies (ICT). When they graduate, they will enter a job market where employees in diverse fields are expected to leverage ICT to support their academic and professional work. Research offers only limited information about college students' digital literacy as it relates to career planning, what college activities and communities of practice encourage the development of digital literacy among students, and the extent to which early experiences with computers and ICT influence college experiences and career aspirations.

The purpose of this study was to learn more about the experiences and individuals that influence students' development of digital literacy and attitudes toward professional career transitions, with a particular focus on the experiences of lower-income students. Digital literacy, as defined by Martin (2008), is the ability to use digital tools to find, sort, analyze, and synthesize information and resources, to effectively communicate with others, and to construct new knowledge, in the context of specific life situations that facilitate reflection and social action. Guided by theories of situated learning (Lave & Wenger, 1991) and differential practices (Sims, 2014), along with boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999), the study employed an explanatory sequential mixed method design (Creswell, 2014) with both quantitative and qualitative methods of data collection and analysis to gain insight from graduating seniors at a selective public research university.

Results indicated that lower-income students, those eligible for federal Pell Grants, reported greater gains in digital competencies as compared to higher-income peers, and that hands-on learning experiences such as undergraduate research appointments and internships were positively related to students' feelings of preparation for the job market and technology demands of work in their chosen career field. Even though most students gained valuable career capital through these experiences, some struggled to draw connections between specific digital competencies and their career goals, and to articulate how these activities had prepared them for the transition to work. Additionally, data from the interviews revealed that very few students had discussed issues of critical information literacy, commercial interests driving the internet, and other related topics in their academic courses or with peers and colleagues.

The study concludes with implications for theory and practice, as well as recommendations for future research to deepen our understanding of the kinds of digital skills

and competencies that students develop through engagement in various activities and communities of practice in college, and how colleges and universities might better serve all individuals in using digital literacy to advance their academic and professional goals.

The dissertation of Brit Toven-Lindsey is approved.

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2017

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CHAPTER 1: INTRODUCTION

"I've never really been a technology person..."

Marisol is a third-year undergraduate at Western University (WU), a selective public research university, who plans to be an elementary school teacher after she earns her degree. She attended a public high school in a rural community, and when asked about her transition to college said, "It's definitely something different than high school especially because of the culture. It's really fascinating for me. I came from an area where it was mainly Hispanics or Latinos, and I had never had a friend who didn't know how to speak Spanish." Marisol didn't grow up with a computer at home because her family "couldn't really afford it," and her parents have never used computers. She didn't start using a computer until she came to college, and when asked about her own views on computers, she said, "I've never really been a technology person... I don't know how to navigate [it] really well." According to Marisol, she avoids technology because "it's something that's really fast for me... it's always changing and I can't keep up with it. I just prefer to do things simply."

In college, Marisol has learned to use basic programs including word processing and slideshow presentation applications, but often uses free online versions because she does not have more expensive programs on her own computer like Microsoft Word and PowerPoint. When asked about the tech culture among her peers she states, "I feel like everyone is at a really high level. Walking around, I see everyone with their phones and going into lectures everyone has Macs.... so sometimes I feel left out. But I can always ask around if I have questions.... I don't have all the devices so I don't know a lot about it. But I don't have problems asking around." Marisol isn't aware of many resources or support systems to help students learn more about computers and other information and communication technologies on her campus. Although she

admits that she may avoid technology resources "by choice," since she doesn't always feel comfortable with her level of familiarity and skill.

Yet, Marisol feels that those who don't have access to technology and a certain level of skills are at a "disadvantage" with regard to gathering accurate and timely information, and gaining access to higher paying jobs. She states, "People look down on [you] if you don't have a job where you use technology." Further, she feels that there is an expectation that college graduates have a certain level of skill related to computers and technology more broadly, and that "for someone who doesn't have those skills it would be more difficult to find a good job." With regard to her own career she states, "I want to be an elementary school teacher... and since I didn't grow up with technology in my elementary school I don't see it as a big part of being a teacher. But I know times are changing and I may need to use [technology] more, so I just feel like I need to prepare or know... how to use different programs." But if given the choice, Marisol would not use technology extensively in her own classroom.

"Technology is a really big part of our lives..."

Adina attends the same university as Marisol. She came to WU after participating in a high school outreach program designed to encourage underrepresented students to pursue higher education. Upon gaining admission, Adina earned a scholarship to help cover the cost of her education and has continued to receive support and guidance from the program during college. Adina started using computers in elementary school, and remembers having a computer at home throughout her childhood. While her parents use computers at work, their family computer was used mainly for "leisure" activities.

Adina attended the "enhanced honors program" at a middle school outside of her home community that had computers in every classroom and utilized technology for a wide range of

activities, including online science labs and group presentations. She later attended high school with many of the peers from her neighborhood and felt like her computer skills were "a lot more proficient" by comparison. Her grandmother bought her a laptop in tenth grade, which she says made her transition to college a lot easier. As she put it, she was "fortunate to have a laptop" because she had many friends who had to visit computer labs to complete assignments while she had the "luxury of doing [her] work at home or taking [her] computer with [her]."

Although she was originally in a science major, Adina became a gender studies major with an education minor. She left her original major because she "really wasn't comfortable in those classes for a lot of social reasons," and her "K-12 preparation didn't necessarily gear [her] toward the mathematics and science needed for those courses." With regard to her college classes, she appreciates it when professors utilize technology in meaningful ways because "technology is a really big part of our lives so you have to integrate things that people do on an everyday basis with the learning aspect."

Adina states that, "50% of the day I'm on my phone, and 20% of that time I'm on my laptop as well." She is active on Facebook, Twitter, Instagram, and other social media sites, and reports that her phone use is "purely social." When she needs to learn a new program or skill on the computer, she will "just play with it until [she] figures it out." As she puts it, "I've never been afraid of breaking a computer... so I use freewill and judgment to figure something out." Despite all this, Adina sees herself as more of a "consumer" of technology than a producer since she isn't using technology to share information and ideas online. She says, "if it was easier, then I would."

With regard to professional aspirations, Adina is interested in education policy and eventually academia. She believes that careers in education policy would "demand a lot of

technological work for research reasons, presentations of various sorts..." and "as a professor, I would like to engage my students" using technology. Although she points out that technology is constantly evolving and therefore she would need to work hard to keep up with her future students, she feels like she is "definitely" up to the task.

Marisol and Adina, both pseudonyms, were participants in a pilot study conducted to investigate differences in college students' level of digital literacy and early experiences with information and communication technologies based on family income. These women are both highly capable and engaged college students. They will each graduate from a highly selective research university, the same institution as students in the current study, and go on to pursue a professional career in their chosen field. Yet, even in an era when college students are often considered "digital natives," having been born into a world of social media and Web 2.0, their stories highlight the diversity of experiences with and attitudes toward technology that college students possess. Why do computing skills and digital literacy matter for college graduates? And why should colleges and universities strive to provide students with opportunities to develop these skills?

Career Planning in a Digital World

One of the major goals for institutions of higher education is to prepare students for professional advancement in their chosen career. In recent decades, computers, the internet, and other digital technologies have significantly influenced the nature of communication, collaboration, and professional work. Technology has been influencing the world of human labor and productivity for centuries from the mechanization of the industrial revolution to the introduction of the internet and World Wide Web in the 1980s to the growth of artificial

intelligence in recent years. With the expansion of big data and analytics, professionals in varying fields rely on computer systems to analyze reams of data and identify patterns, predict behavior, and diagnose problems.

The role of computing and automation has proliferated and today digital technologies are supporting professionals in a wide range of disciplines from helping doctors identify diseases and determine treatment plans to reviewing decades of case law and recommending legal strategies (Carr, 2014). There are tradeoffs to this convenience though. In addition to some workers losing autonomy and the rewards of meaningful work, Carr (2014) argues that automation complacency and bias can lead individuals to place too much trust in digital tools to provide accurate information and carry out complex and elaborate tasks, with little concern for their limitations (p. 67).

Online, personalized search and tailored user experiences made possible by big data and sophisticated algorithms that track our behavior and preferences, have become the standard. As Pariser (2011) put it, “The algorithms that orchestrate our ads are starting to orchestrate our lives,” (p. 9). Google, a dominant force in internet traffic, earns 95% of its revenue from advertising, and some argue that “wealth and power are shifting to those who control the platforms on which all of us create, consume, and connect,” (Taylor, 2014, p. 9). Computers and the internet, and the plethora of commercial enterprises that have built their businesses by utilizing them, offer many modern-day conveniences that help individuals forget about the commercial interests driving these advancements.

In addition, social media and online communities such as Facebook, Twitter, and Reddit have become a driving force in social interaction and self-expression with individuals documenting their daily routines, sharing information and opinion with their networks, and

finding communities of likeminded individuals. These online platforms have created many positive outcomes, but have also ushered in a new era of cyber bullying, trolling, and exploitation, and offered a new platform to ideological groups and online personalities and communities who capitalize on social divisions.

The majority of students on American college campuses today were born into a generation of individuals who have been called, affectionately and otherwise, “Millenials” and “Digital Natives.” Born in the 1990s, they have grown up surrounded by digital technologies and the majority have logged countless hours online communicating with friends, gaming, and “Googling” information. Even though the majority of young people are not spending their time learning to code or producing online content, nearly all of them are regularly interacting with digital tools. Some have even argued that “today’s students think and process information fundamentally differently than their predecessors,” (Prensky, 2011, p. 4). Whether or not this is true, there is broad consensus that college students are quite comfortable using computers for basic tasks. The challenge is moving students beyond these foundational skills to develop digital literacy and the ability to leverage information and communication technologies (ICT) to advance their academic and professional goals. With digital technologies embedded in everyday activities, as well as students’ academic and professional pursuits, it is important that college students gain a critical understanding of the benefits and challenges of living in a digital world. Instead of just relishing the conveniences of modern technologies, college graduates should be critical consumers of information and develop skills in computation, new media literacy, adaptive thinking, and cross-cultural competency (Davies, Fidler & Gorbis, 2011).

Situated within the broad scholarship of new literacies, digital literacy includes the ability to use digital tools to identify, analyze, and synthesize resources, construct new knowledge, and

effectively communicate with others, in the context of specific life situations that facilitate reflection and social action (Martin, 2008). For the purpose of this study, I used Martin's (2008) conceptual framework for understanding digital literacy that includes three levels: digital competence, digital usage, and digital transformation. Digital competence represents the range of basic skills, attitudes and awareness needed to successfully navigate information and communication technologies.

Digital usage builds upon these competencies to situate their use within a particular domain, such as an academic or professional community. Finally, digital transformation involves significant innovation and change within a domain. For Martin, individuals gain digital literacy when they transition from competence to usage, and can apply their skills to a specific domain, or community of practice. Those with high levels of digital literacy are critical consumers of online information who can navigate a range of computer programs and applications and utilize ICT to communicate, research and innovate, and to reflect on social issues.

Unfortunately, the development of digital literacy and technological expertise cannot be viewed as an apolitical process, where curiosity and initiative are paramount. While most schools offer students some level of access to computers and the internet, research points to a new "digital divide" in the way students use technology based on their experiences at home and in school (Ching, Basham & Jang, 2005; Goode, 2010a; Warschauer & Matuchniak, 2010). As Margolis (2010) points out, "When one identifies which students are going beyond learning basic computer literacy skills, critical gaps are revealed – gaps that leave students from different backgrounds prepared for very different futures" (Ch. 6, sec. 2, para. 4).

Further, in a report from the Pew Research Center focused on technology and jobs, the majority of expert respondents were in agreement that the current education system was not

preparing students for the jobs and economy of the future, and many were concerned about the implications of technological advances for social inequality (Smith, Anderson & Rainie, 2014). Today's college graduates are entering a professional workforce influenced by the constant evolution of technological innovation where workers are often expected to be flexible, entrepreneurial, and technically capable (Brynjolfsson & McAfee, 2014; Wilen-Daugenti, 2012). The days of long-term employment at a single firm have been replaced by exponential growth in freelancers, telecommuting, and the distributed workforce (Wilen-Daugenti, 2012). Even in more place-based professional fields such as teaching, health care, and customer service, computer skills and confidence in navigating technology are seen as valuable assets for advancement and innovation.

Purpose and Research Questions

Digital literacy is an essential tool for new professionals and engaged citizens, and colleges and universities need to play a more active role in encouraging the development of these skills through a range of campus experiences. Yet, little is known about the new literacy practices of college students related to career planning, what college activities and communities of practice encourage the development of digital literacy among students, and the extent to which early experiences with technology influence college experiences and career aspirations. The purpose of this study is to investigate the ways that college experiences influence students' development of digital literacy and attitudes toward professional career transitions, with a particular focus on the experiences of lower-income students. The following research questions will guide this study:

1. In what ways do personal background characteristics and early access to technology influence the development of digital literacy among college students?
2. What experiences and interactions during college influence the development of digital literacy among students?
3. In what ways does digital literacy influence college students' academic choices and professional career planning?
4. What are the main sources of information that students use to gather information about the technology demands of specific professional careers?

Theoretical Framework

The objectives of this study are supported by two complementary theories that highlight the influence of sociocultural factors for individuals navigating academic and professional environments. Situated learning theory (Lave & Wenger, 1991) and Sims's (2014) concept of differentiating practices were used to gain a deeper understanding of the ways that college students acquire and utilize digital literacy for academic and professional purposes. The concept of differentiating practices recognizes social practices and power relations as influencing the development of digital inequalities, and seeks to gain a deeper understanding of how individuals navigate these social forces to acquire digital literacies for various purposes. To complement this theoretical grounding, I used the theories of boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999) to consider the ways that students conceptualize and prepare for the transition to work after college.

Building on research related to digital inequality and differential usage of technology, Sim (2014) advances the concept of differentiating practices to explore the ways that social

practices influence inequality related to digital technologies. From this perspective, technology usage is embedded in collective social practices and individuals develop digital literacy through legitimate peripheral participation in specific communities of practice (Lave & Wenger, 1991). Individuals who are engaged in communities of practice move from peripheral participation to a more engaged, central position as their expertise and connection to the community increases. At the same time, social practices are often sites of struggle for legitimacy and acceptance, and these interactions influence social position and identity development. A wide range of factors, including income, education, and race, may influence one's participation in communities of practice and the development of digital literacy. With the fast pace of technological advancement, opportunities to gain new skills and join a particular community of practice will continue to present themselves throughout college and into one's professional career.

The theory of boundaryless careers (Arthur, Claman, & DeFillippi, 1995; Arthur & Rousseau, 1996; DeFillippi & Arthur, 1994) is in many ways a response to shifts in labor relations toward more flexible, temporary, and insecure work. Instead of supporting and relying on an organization for career advancement, the theory focuses on individuals as the central drivers of professional advancement. The notion of boundaryless, or intelligent, careers challenges traditional notions of career development and organizational structure focused on stability, hierarchy, and delineated job descriptions in favor of self-directed careers and individual competencies (DeFillippi & Arthur, 1994).

The authors advance a theory of career capital based on career competencies, or ways of knowing, that individuals accumulate throughout their professional experiences: knowing why, knowing how, and knowing whom. These three competencies encompass an individual's motivation and purpose for pursuing a particular career path, the skills and expertise developed in

various settings, and the social network one develops to with career advancement (Inkson & Arthur, 2001). Boundaryless career theory provides a useful framework for considering the types of skills and experiences that support college students as they plan for and transition to professional careers.

Research Design and Methods

To address the research questions, I used an explanatory sequential mixed method design (Creswell, 2014) with both quantitative and qualitative methods of data collection to learn about the experiences of students at a selective public research university on the west coast of the United States. As the design suggests, data was collected and analyzed in two phases. In the first phase of the study, I analyzed data from the annual senior survey distributed to all students eligible for graduation. The survey includes both closed- and open-ended questions that ask students to provide information about their college experiences, including their academic major and minor, self-ratings of skills and competencies, extra-curricular campus involvement, instructional technology, and post-graduate plans.

Of particular interest were three questions included in the 2015 instrument focused on digital competence and career preparation related to technology. Survey analysis included descriptive and comparative measures, and qualitative analysis of responses to an open-ended question asking students to consider the contributions of their college experiences to their preparation for the technology demands of their future career. In addition, I used structural equation modeling (SEM) to explore the relationship between various factors that predict the development of digital competence and professional career planning, including background characteristics and participation in pre-professional experiences such as internships and research.

The second phase of the study included individual interviews with graduating seniors at the same institution. Fifty-two students completed a screening questionnaire to gather information about their post-graduate plans, self-ratings of digital competence, and personal background characteristics. At the end of the questionnaire, students were invited to participate in a follow-up interview and 16 students completed this process. Students were selected for interviews based on two criteria to ensure variability in the sample: level of self-reported digital competence and family income. Interview data was recorded with permission, transcribed verbatim, and analyzed using QRS NVivo qualitative coding software. In line with the sequential design, the second phase of qualitative data collection was informed by survey data analysis from the first phase. Data from both phases were analyzed independently and together to consider the wide range of factors and experiences that influence students' development of digital literacy and their attitudes and preparation for professional career transitions.

Significance of the Study

Throughout the next chapter, I will review the literature on the changing nature of professional work in the context of rapid technological advances, the persistent disparities in ICT access and usage, and the diverse efforts of schools and institutions of higher education to respond to these social conditions. This study builds on the significant research of K12 scholars who are investigating the influence of educational technology on teaching and learning, and the ways that digital inequality is perpetuating social divisions despite policy efforts to increase access to computers and the internet for all young people. In addition, it recognizes the limited research on college students' new literacy practices and challenges the notion that all college students are digital natives who are confident and comfortable using technology to support their

academic efforts. By investigating the ways that students' social interactions and college experiences influence the development digital literacy, this study provides valuable information about the ways that colleges and universities can support all students are gaining the necessary technology skills for academic and professional success.

CHAPTER 2: LITERATURE REVIEW

Information and communication technologies (ICT) have had a profound influence on American society in terms of personal interactions, industrial productivity, and scientific innovation. The internet and World Wide Web saw rapid growth and adoption in the 1990s with the population of users expanding from 3 million worldwide in 1994 to more than 400 million in 2000 (Norris, 2001). Today, more than 3.25 billion people, or 44% of the world's population, are using the internet (World Bank, 2015), and organizations like Internet.org are trying to expand access even further (Zuckerberg, 2014). A recent national survey conducted by the Pew Research Center on people's attitudes toward technology in the next 50 years found that 59% of Americans polled felt that the long-term impact of technological advancements would be the improvement of people's lives (Smith, 2014a).

While it is clear that computers and related technologies have brought many positive changes to society, from expanding access to information to advancing medical research and disease prevention, many argue that the digital revolution has not benefitted all people and is, on the contrary, creating social inequalities in much the same way that previous societal shifts such as the industrial revolution have (DiMaggio & Hargittai, 2001; McChesney, 2013; Taylor, 2014; Wilkie, 2011). The review of the literature relevant to the study is organized in two parts. The first part will focus on the changing workforce and the ways that information and communication technologies (ICT) are influencing personal and professional opportunities, schooling, and higher education. Specifically, I will briefly discuss the ways that technological advances are influencing professional work and placing demands for new skills and competencies on workers. I will then provide an overview of research related to the digital divide in American society, and the heightened focus on incorporating computers and ICT into curriculum and training in schools

and institutions of higher education. The next section will look at higher education in the context of this changing work culture, including the economic benefits of college, calls to prepare graduates for 21st century jobs, and the career preparation and transitions of graduates. The second part of the literature review will focus on literacy and learning, beginning with a brief overview of beliefs about literacy and the many different understandings of digital literacies that have developed in recent decades. I will then use Martin's (2008) conceptual framework to provide a working definition of digital literacy for the study. Finally, I will briefly explore the ways that college students are using ICT and developing digital literacy skills for academic, personal, and professional purposes.

Part I. Technology, Education and Professional Work

The Changing Nature of Work

The link between education and economic opportunity is a hallmark of the American narrative of prosperity. According to a Pew Research Center Report on the value of higher education, "On virtually every measure of economic well-being and career attainment—from personal earnings to job satisfaction to the share employed full time—young college graduates are outperforming their peers with less education," (Taylor, Fry & Oates, 2014, p. 3). While this trend has been present for past generations, disparities in economic outcomes have never been greater. The American labor market has changed substantially based on a number of developments including, globalization, industrial and corporate restructuring, the decline of labor unions, demographic shifts, and technological advances, with globalization and technological change, in particular, leading to greater opportunities for those with higher levels of education and specialized skills (Kirsch, Braun, Yamamoto & Sum, 2007; Wolff, 2006).

A major factor in the advancement of highly educated workers is the changing nature of the global economy bolstered by advances in information and communication technologies (e.g., Carlsson, 2004; Kirsch et al., 2007; Martinez, Rodriguez & Torres, 2010). Kalleberg (2009) argues that technological advances drove companies to be more globally competitive while also making it possible for them to do so. Using representative data on labor task inputs from 1960 to 1998, Autor, Levy and Murnane (2003) found that as computer technology advanced to manage routine cognitive and manual labor tasks, demand for workers who could execute non-routine cognitive tasks needing flexibility, problem-solving, creativity, and complex communications increased substantially. Similarly, Wolff (2006) points out that between 1950 and 2003 there was a significant decrease in the proportion of blue-collar work from 53 to 24 percent of employment, while professional, technical, and managerial positions increased from 47 to 76 percent of the overall workforce. Using composite measures of labor skills including substantive complexity, interactive skills, motor skills, and median years of schooling, Wolff found that, with the exception of motor skills, changing employment patterns between 1950 and 2000 led to increased skill requirements for employees.

Levy and Murnane (2004) argue that there is a new division of labor between humans and computers, and a "growing division within human labor itself – a divide between those who can and those who cannot do valued work in an economy filled with computers" (p. 1). With advances in information technologies, the authors point out that computers commonly process information more rapidly and at lower cost than humans. Yet, computers generally lack the ability to solve new or unanticipated problems, and utilize intuitive or tacit knowledge to approach these challenges. For Levy and Murnane, the challenge for educators is to recognize the changing nature of work and prepare young people to succeed in this new environment.

Specifically, they argue that as computers take on more complex tasks, employers value workers with expert thinking and complex communication skills, and those who can use computers and information technologies to complement their creativity and productivity.

Brynjolfsson and McAfee (2014) build on this earlier work and argue that ideation, innovation, and complex communication skills are important areas of distinction between humans and machines. While computers often support and accelerate these efforts, curious and creative individuals who are able to critically evaluate and analyze information and come up with new ideas and ways of tackling challenges will remain highly valuable to employers and society more broadly. Brynjolfsson and McAfee also argue that traditional models of schooling, focused on rote memorization along with reading, writing and arithmetic, are not preparing students with the necessary skills for the modern economy and jobs. As they put it, "the three *Rs* were once the skills that workers needed to contribute to the most advanced economy of the time... but that time and place are no longer ours" (p. 194). For Brynjolfsson and McAfee, students should be engaged in self-directed learning activities where they utilize ICT to gather information and connect their learning to real world challenges, and in turn, develop their skills in ideation, pattern recognition, and complex communication.

Toyama (2015) makes a similar argument with regard to the human-computer interaction arguing that technology serves to amplify human activities and efforts. He considers this technology's *Law of Amplification*, and uses countless real world examples to argue that technologies have no "fixed additive effects" (p. 30) and that their effects can in fact be positive, negative or neutral depending on social and contextual factors. To further his point, Toyama cites many examples of large-scale education technology initiatives designed to prepare children with skills for the information age that ultimately failed to produce positive changes in student

learning and engagement. As a technology enthusiast, he is not advocating for the exclusion of technology in classrooms. Instead, Toyama highlights the limitations of simply providing individuals with unfettered access to computers and ICT. He states,

there's a big difference between learning the digital tools of modern life (easy to pick up and getting easier by the day, thanks to improving technology) and learning the critical thinking skills necessary for an information age (hard to learn and therefore demanding good adult guidance). If anything, it's less useful to master the tools of today, because we know there will be different tools tomorrow (2005, p. 13-14).

For Toyama, it is important to recognize that children, and learners in general, need guidance and encouragement from knowledgeable teachers to master new skills, and that technology alone does not solve social challenges.

While digital tools and computer automation provide benefits for productivity and efficiency, there are also negative effects as workers are separated from meaningful hands-on tasks and take on more of a monitoring role. As Carr (2014) points out,

It may seem as though a factory worker operating a noisy industrial machine has little in common with a highly-educated professional entering esoteric information through a touchscreen or keyboard in a quiet office. But in both cases, we see a person sharing a job with an automated system... the sophistication of the system, whether it operates mechanically or digitally, determines how roles and responsibilities are divided and, in turn, the set of skills each party is called upon to exercise (p. 112)

In addition, this separation can lead to what Carr (2014) calls automation complacency and bias as professionals put their trust in machines to support their work. He argues that individuals are socialized to believe the computers don't make mistakes, even though there are countless

examples of glitches in automatic systems that have caused major problems before they were discovered and corrected. Further, automation limits individuals' need to generation information on their own, which can undercut the development of deeper concept mastery and retention among learners (Carr, 2014; Karpicke & Blunt, 2011).

While there is little consensus about the ways that computers and ICT should be used in schools and classrooms more broadly, education scholars generally recognize the need for curricula that incorporates elements of the evolving technology-supported professional environment in which children should be prepared to participate. Further, there is much scholarly and public discourse about the ways that ICT has influenced professional organizational structures, employment arrangements, and the demands that employers place on workers, which all have implications for schools and institutions of higher education. Wolff (2006) argues that computerization is strongly associated with structural changes in professional organizations. His international labor study found that the diffusion of IT in the U.S. economy has done more to influence organizational structure and workflow than to increase productivity, as conventionally measured.

Today's college graduates are entering a labor market where employers demand a wide range of technical, interpersonal, and conceptual skills from employees, and the average worker has been with their current employer for less than five years (BLS, 2014a). Findings from the National Longitudinal Survey of Youth 1997 indicate that young people hold an average of 6.2 jobs from age 18 to 26, and that women with more education held more jobs on average than women with less education (BLS, 2014b). While some would argue that young people move from job to job before settling into long-term employment with a single organization, results from a previous iteration of this study focused on individuals born between 1957 and 1964

indicate that this trend continues to some extent throughout individuals' careers. Participants of this earlier study held an average of 11.3 jobs from age 18 to 46, and more than two-thirds of relationships with a single employer ended within five years regardless of the age at which employment commenced (BLS, 2012).

With the help of ICT and other digital technologies, work environments and employment arrangements have also become more variable and distributed. Telecommuting has increased as much as 400% in recent years, and there were more than 12 million full-time, home-based freelance workers and independent contractors, those who are self-employed and not tied to any particular client or company long term, in the U.S. in 2010 (Wilen-Daugenti, 2012). Precarious work, or "employment that is uncertain, unpredictable, and risky from the point of view of the worker" has become a more prominent feature of the labor market as well (Kalleberg, 2009, p. 2). The global scale of the workforce allows employers to exert power over a distributed workforce, and layoffs have become a basic component of employer restructuring to reduce costs. Further, while it was once a feature of a dual labor market, precarious work has spread to all sectors of the economy including professional and managerial jobs (Kalleberg, 2009).

Many of these changes in the global economy and labor market reinforce the idea that skilled workers, and recent graduates in particular, must take a more active role in developing their professional skills and managing their own career path. As Wilen-Daugenti (2012) states, "We are swiftly moving away from assured employment and into a free-market economy for educated, skilled, technically capable talent, and the impact on society and education has been profound," (p. 67). There is much interest and debate among policymakers about the best ways to prepare the changing needs of the professional labor market, including a special focus on schools and institutions of higher education. In the following section I will explore the concept of the

digital divide and policies designed to increase access to ICT in schools and society more broadly.

Evolution of the Digital Divide

As the internet and web have become an increasingly important part of everyday life throughout the 1990s, researchers and policymakers were interested in the ways that these new technologies were creating disparities in society. The term "digital divide" was used by the U.S. Department of Commerce National Telecommunications & Information Administration (NTIA) in a series of reports that highlighted the disparities in access to the internet among groups of Americans. In the report entitled, *Falling Through the Net: Defining the Digital Divide*, NTIA articulated the digital divide as "the divide between those with access to new technologies [including 'telephones, computers, and the Internet'] and those without" (Irving, Klegar-Levy, Everette, Reynolds & Lader, 1999, p. xiii). They used terms such as "haves" and "have nots" to talk about those groups in American society who were benefitting from the internet while others were stagnating and even falling behind.

Numerous theories have been used to consider the trajectory of technology diffusion and adoption, and the debate about the benefits and challenges of digital technologies continues today. Many cyber-optimists believed that the growth of the internet would follow a normalization pattern, with adoption increasing in an "S-(Sigmoid)" pattern with slow initial adoption of new technology followed by substantial advances in usage and then eventually a slowing of demand as widespread use is maintained (Norris, 2001). In this model, the early adopters gain the relevant knowledge and skills to take advantage of computers and the internet. But as demand grows and prices and access follow, saturation allows late adopters to catch up and the initial inequalities created by this new technology diminish.

Those with a more skeptical outlook of technological advancement and adoption in society saw the stratification model as a more realistic alternative, where those groups who already enjoyed higher status in social networks and greater access to traditional forms of information and communication technologies maintain their status and privileged position despite the eventual penetration of the new technology into society (Norris, 2001). In addition, some scholars question the motives of the global agenda to increase access to ICT in poorer parts of the world at the expense of other more pressing issues as a “convergence of interests” that “set the political agenda in such a way that the digital divide is now seen as a serious and important social problem,” (Luyt, 2004, sect. 1, para. 6). Luyt argues that a number of interdependent interests drive this push to reduce the digital divide, including global capitalists in search of new markets and educated workers, state actors in recipient countries who gain legitimacy and resources for specific sectors of the population, and the development community who facilitate and champion the process.

While many theories related to the influence of technology on social relations have been advanced throughout the years, DiMaggio, Hargittai, Celeste and Shafer (2004) point to three conclusions that they believe many scholars can agree upon. First, the various forms that new technology take and their social implications are a product of human design and are based on the interests of those who invest in their advancement. Second, they argue that technologies are constantly being altered and reinvented by both designers and users. And finally, DiMaggio et. al. (2004) state that the development of new technologies is influenced by social practices and human concerns as opposed to technology shaping society.

These broad conclusions seem quite intuitive but they also highlight the fact that ICT can be a vehicle for greater social equality or a driver of social and economic advancement for the

lucky few who harness its power for personal gain. Commercial interests dominate the computer industry and internet, and “technology is regarded as an arena that the government must not touch, the state said to be too ossified and slow to keep up with Silicon Valley’s rapid pace” despite that fact that the federal government provides “massive and ongoing funding” to support it (Taylor, 2014, p. 223). This somewhat hands-off approach has led to consolidation and even monopolization of the internet and ICT. The internet, which was conceived as a free and open platform, is dominated by companies that generate billions of dollars in revenue each year. Reports indicate that Google control 65% of internet search traffic (Sterling, 2015), and Facebook had 262 million active users in 2016 (Kemp, 2017).

As discussed previously, internet use has grown rapidly in the United States with around 88% of the population using the internet in some capacity in 2017, and 66% of Americans having a social media profile on sites such as Facebook or LinkedIn (Kemp, 2017). Yet, the United States is also a world leader in social inequality and it is therefore not surprising that some citizens still report that they do not use computers and the internet because they either can't afford it or feel that they have no use for it. In 2011, 30 percent of the 119 million households included in a national study of American's online experience reported that they did not use broadband at home (NTIA, 2013).

Much research on the digital divide throughout the past few decades has identified disparities based on income, race, gender, education, and geography with those having higher income and more education in urban and suburban locations faring better (e.g., Bimber, 2000; NTIA, 2013; Wilson, Wallin & Reiser, 2003). According to National Telecommunications and Information Administration, seven in 10 households used broadband internet at home by 2011, but "low-income, non-Asian minority, and rural households were much less likely to be

connected than their more affluent, urban, and white or Asian American counterparts" (2013, p. vii). Household income remains a strong predictor of broadband access; 85% of households with an annual income above \$50,000 have broadband access compared to only 43 percent of lower-income households. According to the report, education is another important factor in broadband access (NTIA, 2013). Nearly nine in 10 households headed by college degree holders had broadband access, while only 55 percent of high school diploma holders and 35 percent of those without a high school education enjoyed high-speed internet access.

In recent years, computers, high-speed internet access, and smart phones have become more widely used among all racial and ethnic groups, in part due to the lower cost of devices and network service. In a report from the Pew Research Center focused specifically on technology usage among African Americans, researchers found that younger, college-educated, and higher-income African Americans are just as likely as their white peers to have broadband internet access at home (Smith, 2014b). Further, the vast majority (96%) of African American internet users age 18-29 use social media sites regularly, and are just as likely as their white peers to own and use a smart phone. In California, where 69% of residents have broadband Internet access, disparities persist. Even though access has expanded in recent years, only 52% of Latino/as in California use broadband internet, compared to 71% of African Americans, 75% of Asian Americans, and 81% of whites (Baldassare, Bonner, Petek, & Shrestha, 2013). Although U.S. born Latino/as enjoy higher rates of broadband access (74%), those who are foreign born (35%), prefer to speak Spanish (28%), and earn less than \$40,000 per year (45%) are much less likely to use it.

Even though differences in access based solely on race may be improving, a study by Mossberger, Tolbert and Gilbert (2006) used multi-level modeling to test the impact of place, or

living in an area of concentrated poverty, on an individuals' access to the internet and their ability to learn about and use computers. Their findings indicated that many individuals living in low-income communities recognized the importance of learning computer skills and were interested in gaining access to new knowledge through various forms of training. Yet, study participants still had lower levels of internet access and usage. According to the authors, the combination of racial segregation and concentrated poverty provides a better explanation for technology disparities often attributed to race alone, (Mossberger et al., 2006). In a more recent study of similar design, Mossberger, Tolbert, Bowen, and Jimenez (2012), found that “poor communities magnify individual disadvantage” when it comes to internet access and usage, with predominantly African American and Latino communities most significantly impacted.

Federal programs do supply some funding for broadband infrastructure and internet access for schools and libraries (Kruger & Gilroy, 2013), but efforts to ensure that all citizens have opportunities to develop computer skills and access information online are limited. Some local initiatives, such as Community Technology Centers (CTCs), have been created to provide basic access to technology to underserved populations. While these efforts are positive, Wolske, Williams, Noble, Johnson and Duple (2010) argue that CTCs should be transformed to emphasize social inclusion and the empowerment of individuals and communities to utilize technology for social and political engagement and information sharing. In the digital age, many scholars argue that social inclusion and digital literacy means more than simply providing the "have nots" with access to computers and the internet.

Moving beyond the binary of physical access. Researchers have moved beyond the dichotomous notion of "haves" and "have nots" in terms of access to computers and ICT by pointing to a more nuanced understanding of the digital divide (e.g., Gorski, 2003; Howard,

Busch & Sheets, 2010; van Deursen & van Dijk, 2014). Norris (2001) defined the digital divide as a multidimensional phenomenon that encompasses a global divide between industrialized and developing countries, a social divide between those with and without full access to these technologies within each country, and the democratic divide between those who do and do not use digital resources to engage in public life. For Norris,

The chief concern about the digital divide is that the underclass of info-poor may become further marginalized in societies where basic computer skills are becoming essential for economic success and personal advancement, entry to good career and educational opportunities, full access to social networks, and opportunities for civic engagement (2001, Ch. 4, para. 2).

In one component of her expansive study, Norris uses a comparative lens to consider patterns of internet adoption across Europe broken down by social class, gender, education, and age, as compared to previous technologies such as cable television, VCRs, and fax machines. Internet access was significantly associated with the adoption of all forms of communication technology, and followed similar patterns of diffusion. These findings suggest that the digital divide is closely linked to broader issues of social stratification that advantage certain groups based on income, occupation, and social class, and that differences in technology usage cannot be explained simply by the nature of the technology or individual anxieties (Norris, 2001). Persistent disparities also exacerbate inequality by narrowing an important avenue to participation in democratic society, and by limiting access to social and cultural capital that increases one's position in the knowledge economy (Howard et al., 2010).

Similarly, Mossberger, Tolbert and Stansbury (2003) advocated for a more robust assessment of the digital divide, which they saw as primarily focused on improving hardware

and infrastructure. They argued that mere access is insufficient if individuals do not have the necessary skills to take advantage of technology, and thus understanding the experiences and attitudes of disadvantaged groups was essential. Utilizing data collected from a national phone survey of low-income residents, Mossberger et. al. (2003) measured multiple divides related to computers and information technology: the access divide (location and frequency of computer/internet use), the skills divide (technical competence and information literacy), the economic opportunity divide (beliefs about economic advancement and experiences with information seeking), and the democratic divide (attitudes and experiences regarding political engagement and gather information).

With regard to access, their findings were similar to those previously stated. Namely, that the persistent access gap is related to factors such as education, income, age, and race. The skills divide followed the same pattern as the access divide, with older, less-educated, low-income, African American and Latino/a individuals needing more assistance to complete computer tasks, which the authors argue is related to disparities in computer ownership and home access to the internet. In terms of economic opportunity, the majority of respondents tied computer and ICT competencies to economic advancement, and low-income and minority communities were particularly cognizant of this connection. Therefore, Mossberger et. al. (2003) argued that "the task is not so much to convince individuals that these skills are necessary, but rather to make technology and instruction available and relevant to job search, career development, and small business needs" (p. 119). Finally, the authors found that young people, as well as more affluent and educated individuals, were more likely to use the internet for political engagement and accessing government information.

In an ethnographic study with 100 low-income new- and non-users of computers and the internet in California, Stanley (2003) found that a lack of physical access to computers is not enough to explain disparities in usage among particular groups of people. While some participants did mention cost as an obstacle to computer ownership, the majority emphasized non-cost related barriers. Stanley (2003) articulated these obstacles as relevance, comfort zone, and self-concept. Forty percent of respondents reported that they did not see computer literacy as relevant to their lives or a means to social and economic enrichment, which the author argues is based on a lack of exposure and knowledge about the benefits of computer literacy. Further she argues that the high social costs such as difficulty of use, a lack of technical competencies, and anxiety associated with using computers combine to challenge non-user's physical and psychological comfort zone, leading many non-users avoid computers all together.

Finally, Stanley (2003) points to self-concept as another obstacle to computer literacy. She states that, "Fully 7 of 10 respondents said that, in one way or another, they initially believed themselves to be unlike the 'type' of person who uses computers either personally or professionally" (p. 412). Stanley argues that access to computers as part of everyday life is important to seeing oneself as a "computer person." Therefore, lack of exposure to computers in your personal life or among those in your social network, can limit one's choice to gain new skills. While access to high-speed internet and smart phones for low-income individuals has continued to grow over the years, more recent research indicates that sustained access is still a challenge for some as they struggle to maintain and update their devices for regular use (e.g., Gonzales, 2016; Gonzales, Ems & Suri, 201)

Advancing Social Inclusion in a Digital Era

In his book, *Technology and Social Inclusion: Rethinking the Digital Divide*, Warschauer (2004) argues that, "the diffusion of any technology is a site of struggle, with access policy reflecting broader issues of political, social, and economic power" (Ch. 2, para. 14). He advocates for a more sophisticated understanding of ICT access that promotes social inclusion. Warschauer identifies four general categories of resources needed for developing digital literacy and the effective use of ICT: physical (access to computers and other devices), digital (information and materials available online), human (literacy and education), and social (community, institutional, and societal structures). If managed properly, each of these resources encourages inclusiveness in ICT usage and digital literacy development, and is also a result of it. At the same time, limiting access to these resources can perpetuate a cycle of exclusion and stagnation in individual adoption.

Similar to Noble (2001), Warschauer argues that disparities in physical access to the internet will be a long-term challenge in the U.S. and globally, based on comparison data for previous adoption patterns of technological innovations and the rapid pace of advancement. He points out that computer and internet access, as previously discussed, is stratified and tied to social factors such as race, income, and education. Further, limited government intervention to encourage social inclusion and a commercial market focused on profit margins and developing products for a small portion of the population reinforce limits to widespread access and use. Howard et al. (2010) found that U.S. policies, as compared to Canadian policies, have generally focused on physical access to ICT as opposed to the promotion of digital literacy and the development of cultural content online, which has resulted in persistent disparities in internet usage among citizens based on income and education.

Based on a review of the literature, DiMaggio and Hargittai (2004) articulate five areas of digital inequality including differences in equipment, autonomy of use, skills and knowledge, available support system, and needs and purpose of use. They state, "We view each type of inequality as likely to shape significantly the experience that users have online, the uses to which they can put the internet and the satisfactions they draw from it, and their returns to internet use in the form of such outcomes as earnings or political efficacy" (p. 31). DiMaggio and Hargittai advocate for an expanded research agenda that focuses on the full range of digital inequalities, and a deeper understanding of the mechanisms, institutional factors, and consequences of these disparities for individuals' personal and professional advancement. More recently, a group of scholars from various fields articulated their view that digital inequality had emerged as a prominent form of inequality, and should be included as a factor in research more broadly on life chances and trajectories (Robinson, Cotten, Ono, Quan-Haase, Mesch, Chen, Schulz, Hale & Stern, 2015). The authors argue that, "It is increasingly clear that individuals' digital engagements and digital capital play key roles in a range of outcomes, from academic performance to labor market success to entrepreneurship to health services uptake" (Robinson et al., 2015, p. 569).

With regard to digital resources, Warschauer (2004) identified numerous content-related barriers to social inclusion, including a lack of locally relevant information, non-English language resources, diverse cultural materials, and information accessible to those with disabilities. Further, online content and search engines are not a neutral space with regard to the representation of individuals and groups. Noble (2013) utilized critical discourse analysis to examine Google search engine results for Black women and girls, and the study's findings were highly troubling. Half of the first ten results on a key word search for "Black girls" included

content where girls were "sexualized or pornified," while only three of the results were blogs related to some aspect of social or cultural life (Sect. 6, para. 2). As Noble states,

At the heart of the public's general understanding and trust in commercial search engines like Google, is a belief in the neutrality of technology—a technologically deterministic blind spot to the embedded social values in technology design itself—which only obscures our ability to understand the potency of misrepresentation that further marginalizes and renders the interests of Black women, coded as girls, invisible," (Sect. 2, para. 3).

While the sheer volume and production of online content is astounding, this does not equate to meeting the needs of diverse communities or encouraging social inclusion. This study also highlights the importance of educating young people about bias and commercial interests embedded in online search engines and other digital tools, and encouraging the development of higher levels of digital literacy to support their academic and professional endeavors.

Education is an important component of effective ICT usage that helps to determine how people use the internet and the benefits they accrue from it. Warschauer (2004) argues that as internet usage becomes more widespread it will also be increasingly stratified in terms of usage, with some individuals using the internet solely for entertainment purposes and more sophisticated users seeking and creating new knowledge using a wide range of digital tools. Warschauer points to electronic literacy, an umbrella term he uses to encompass a range of literacies including computer, information, multimedia, and computer-mediated communication, as an essential skill for the information era, and advocates for a constructivist approach to education that incorporates social factors and context.

Communities of practice, advanced by Lave and Wenger (1991), focus on collaborative learning and apprenticeship, where learners and experts interact to develop new skills and knowledge through observation, experimentation, modeling, and feedback. For Warschauer (2004), communities of practice are an important means to social inclusion of ICT usage. He states, "*learning how* is intimately tied up with *learning to be*, in other words developing the disposition, demeanor, outlook and identity of the practitioners," (2004, Ch. 5, sec. 8, para. 5). Therefore, true mastery involves individuals developing confidence with regard to their digital literacy skills and identify as a person who can effectively utilize technology in various settings.

Computer confidence and self-efficacy. Based on the desire for a deeper examination of the social and psychological barriers that influence the digital divide, numerous scholars have utilized Bandura's social cognitive theory and notion of self-efficacy to consider the ways that individuals interact with new communication technologies. Bandura (1982) defines self-efficacy as "judgments of how well one can execute courses of action required to deal with prospective situations" and "one set of proximal determinants of how people behave, their thought patterns, and the emotional reactions they experience in taxing situations" (p. 122-23). From his theory, scholars have developed various self-efficacy measures related to technology usage, including computer self-efficacy (Cassidy & Eachus, 2002; Compeau & Higgins, 1995; Murphy, Coover & Owen, 1989), web user self-efficacy (Eachus & Cassidy, 2006), and internet self-efficacy (Kim & Glassman, 2013).

Compeau and Higgins (1995) developed one of the early models of computer self-efficacy based on the "ongoing reciprocal interaction between cognitive factors, environment and behavior" advanced in social cognitive theory (p. 194). With regard to computers, the model highlights factors that influence attitudes and usage including encouragement from others in

one's reference group, seeing others in the reference group using computers, and organizational support, as well as a person's beliefs about the expected outcomes of gaining new computer skills. These factors all influence a person's affect and anxiety with regard to computers, and subsequently their level of usage. Therefore, if a person does not see many people in their life using computers, does not get encouragement or support to interact with computers themselves, and does not understand the benefits of gaining these skills, they may develop low computer self-efficacy accompanied by high anxiety and displeasure in using this technology.

The computer self-efficacy measure developed by Compeau and Higgins has been tested in numerous studies (e.g., Agarwal, Sambamurthy, & Stair, 2000; Eastin & LaRose, 2006; Hauser, Paul & Bradley, 2012; Marakas, Johnson & Clay, 2007). In a longitudinal study of 394 business professionals, Compeau, Higgins and Huff (1999) found that computer self-efficacy positively influenced an individual's personal and performance-related expected outcomes. Higher levels of computer self-efficacy also had a positive influence on affect and use, and a negative influence on anxiety. Further, expected outcomes related to performance had a positive influence on a person's affect and usage of computers. In other words, those with more confidence in their abilities to use computers anticipated a more positive experience and outcomes, were more likely to use computers regularly, and had less anxiety related the experience.

The model was adapted for a study of 750 undergraduates at a public university in the Southwest region of the United States, with a focus on the influence of gender roles on technology self-efficacy (Huffman, Whetten & Huffman, 2013). Results indicated that males reported higher levels of perceived technology ability than females, but that sex was mediated by gender roles (masculine and feminine) in subsequent analysis. Further analysis using hierarchical

regression found that gender roles predicted an individual's relationship with technology controlling for sex, perceived computer hassles, and perceived levels of structural technology support from one's institution. Masculine gender roles also predicted higher levels of technology self-efficacy among college students. Huffman et al. (2013) argue that universities should provide proper training for both male and female faculty and instructors, as well as implementing gender-neutral interventions to encourage equitable access and ownership of technology among students.

Numerous studies have also explored the computer and technology self-efficacy of pre-service and in-service teachers (e.g., Abbitt & Klett, 2007; Brinkerhoff, 2009; Koh & Frick, 2009; Papastergiou, 2010; Wang, Ertmer & Newby, 2004). Technology integration has become a major focus in schools, and teachers are expected to effectively utilize technology in their classrooms. Many studies utilize pre- and post-experience surveys to measure changes in computer self-efficacy and perceived skills for technology integration in teaching after a technology course or professional development training. In their study of 408 undergraduate education majors who participated in several variations of an introductory technology course, Wang et al. (2004) found that providing students with examples of best practices (vicarious experiences) and goal setting for instructional improvement using technology significantly increased participants' self-efficacy for technology integration.

Similarly, in their study of 109 undergraduates enrolled in a teacher preparation program, Abbitt and Klett (2009) found that ratings of self-efficacy, perceived usefulness, and comfort with computer technology were higher for all groups who participated in one of four courses focused on technology integration into teaching. Based on their findings, their authors suggest that courses that were designed to explore technology integration in teaching and learning more

broadly were more advantageous for participants' than courses narrowly focused on developing proficiency in specific skills and competencies.

Classroom pedagogy and instructional techniques used in educational technology courses can also influence students' engagement and development of computer self-efficacy. In their study of 43 pre-service teachers enrolled in three sections of an educational technology course at a large Midwestern university, Koh and Frick (2009) found that the instructors' use of scaffolding techniques such as presenting information (show and tell) while also asking students answer questions (prompt and hint), engaging students in hands-on practices and regularly checking their progress, and inviting students to share suggestions and perspectives with the class while providing reinforcement (direction maintenance) were all associated with increased self-efficacy and engagement.

Findings from these studies of self-efficacy are consistent with the concept of situated learning and communities of practice discussed previously. While it is not surprising that encouraging students to engage in hands-on activities guided by expert instruction would increase confidence and perceived usefulness, these studies also point to the importance of context. In other words, learning new computer skills and gaining confidence related to information and communication technologies is most effective when these skills and competencies are relevant to a person's interests, goals, and community. These studies also illustrate the growing interest in instructional technology integration in teaching and learning that has emerged in the past several decades. The following sections will provide a brief discussion of instructional technologies in schools and universities. While a thorough discussion of education technology is beyond the scope of this study, it is important to consider the ways that schools and institutions of higher education are responding to calls for an increased use of technology in

curriculum and instruction, and the need to prepare students with 21st century skills and competencies for the new knowledge economy.

Instructional Technology Integration in Schools

Schools have become ground zero for an ongoing debate about the ways that technology can positively, and negatively, influence teaching and learning. From literacy to STEM, advocates argue that investments in technology infrastructure and various programs and applications will improve student learning, engagement, and retention, while critics worry that technology plans are often poorly implemented, costly, and may even worsen disparities in student achievement. *Inside Higher Education* reported that investments in education technology companies exceeded \$2.5 billion in the first half of 2015 (Straumsheim, 2015). In a second-order meta-analysis of more than 40 years of data, Tamim, Bernard, Borokhovski, Abrami and Schmid (2011) found that technology-enhanced instruction had a significant small to moderate positive effect on student achievement. At the same time, differences persist in the way technology is used in schools, with many low-income students having limited opportunities to engage with ICT in meaningful and creative ways, compared to their higher income peers (Bull & Bull, 2003; Banister & Reinhart, 2011; Morse, 2003).

According to the National Center for Education Statistics, 99% of public schools had access to the internet in 2001, with 85% having a high-speed or broadband connection (Kleiner & Farris, 2002). Yet, these statistics can be deceiving. According to recent remarks from President Obama, "Only around 30 percent of our students have true high-speed internet in the classroom... In a country where we expect free Wi-Fi with our coffee, we should definitely demand it in our schools" (The White House, Office of the Press Secretary, 2014). In line with this comment, reports indicate that as many as 70% of public K-12 schools do not have sufficient

broadband to allow a majority of their students to engage in digital learning and many teachers in high-poverty schools feel that students' lack of digital tools at home presents a challenge in their classroom (Darling-Hammond, Zielezinski & Goldman, 2014).

In 2014, the Federal Communications Commission (FCC) adopted the *E-rate Modernization Order* designed to ensure, "affordable access to high-speed broadband sufficient to support digital learning in schools and robust connectivity for all libraries," (FCC, 2014, p. 12). The program is designed to help lower-resourced schools gain equal access to broadband internet that will facilitate the effective use of educational technology tools in the classroom. According to a report from the Evergreen Education Group (2015) that puts out an annual report about digital learning, "millions of students are taking supplemental online courses while attending a physical school" (p. 13) and "most [public school] districts are using some form of digital learning," (p. 25). Digital learning, in this report, is defined as any instructional practice that uses digital tools from fully online courses to digital enhancements to classroom instruction. Although, as the previous sections suggest, access alone is not enough to ensure that school will use technology in ways that encourage student learning and engagement.

Provisions within the *No Child Left Behind* legislation also focused on further increasing technology integration in schools. The Enhancing Education Through Technology Act of 2001 had a primary goal to improve the academic achievement of elementary and secondary students through the use of technology in schools, with additional goals of ensuring that every student is technologically literate by eighth grade, regardless of race, ethnicity, gender, disability, family income, or geographic location, and encouraging effective use of technology in teacher training and curriculum development (U.S. Department of Education, 2001). While many scholars have critiqued the legislation for its narrow focus on improving reading and math scores (e.g.,

Cochran-Smith & Lytle, 2006; Kim & Sunderman, 2005), with regard to technology implementation much debate has centered on computer-based tutorial learning and findings have been mixed.

A national study commissioned by the U.S. Department of Education to examine the effectiveness of a range of software products on reading and math instruction found that online tutorial learning had no significant effect on test scores in the first year (Campuzano, Dynarski, Agodini, and Rall, 2009). The second year of the study examined whether additional experience teaching with the software products would increase student test scores, but findings were similar with online tutorial learning still having no effect on reading test scores for first or fourth graders, a negative impact on sixth grade math scores, and a small positive effect on Algebra I scores. In a randomized controlled trial of more than 2,000 fourth-graders in Pennsylvania, Wijekumar, Meyer & Lei (2012) examined the effects of a single web-based tutoring program on reading comprehension. Results indicated that this particular intervention had a statistically significant positive effect on reading comprehension. These disparate findings suggest that a wide range of factors influence the success of technology integration projects in schools, from resource allocation to training to implementation.

Similar to *No Child Left Behind*, the Common Core State Standards developed by the Council of Chief State School Officers and the National Governors Association include a focus on preparing students for the technology demands of their personal and professional futures. Students who are college and career ready according to these standards, "employ technology thoughtfully to enhance their reading, writing, speaking, listening, and language use," (Common Core State Standards Initiative, 2010a, p. 7). With regard to mathematics, proficient students need to be able to use a wide range of tools from "pencil and paper" to "a computer algebra system, a

statistical package, or dynamic geometry software" and "use technological tools to explore and deepen their understanding of concepts" (Common Core State Standards Initiative, 2010b, p. 7).

These standards were designed to prepare students for entry-level careers, college courses, and workforce training programs, and have received considerable buy-in from education stakeholders across the country. Based on a comparative analysis of Common Core standards and previous state standards along with survey data on teaching practices from nearly 2,500 teachers, Porter, McMaken, Hwang, and Yang (2011) found that the Common Core standards represented a considerable change from current state standards and assessment measures. Time will tell if these new standards encourage student achievement, lessen disparities across states and schools, and provide a useful framework for effective technology integration.

Beyond national standards and performance indicators, many education scholars are interested in examining the diverse ways that technology is utilized in schools and how it might influence students' performance and persistence. Numerous factors impact differential usage of technology in schools, including the presence of stable staff and support systems, the number of English language learners and other at-risk students, pressure to improve standardized test scores, and students' level of experience with ICT and access to computers at home (Warschauer & Matuchniak, 2010). National statistics on teachers' use of education technology also indicate differences among schools with low and high levels of poverty concentration (Gray, Thomas and Lewis, 2010). Teachers in low-poverty schools were more likely than their counterparts at high-poverty schools to report that their students sometimes or often used education technology to prepare written text (66 and 56 percent, respectively), and develop and present multimedia presentations (47 and 36 percent, respectively). By contrast, teachers at high-poverty schools

reported greater usage of technology tools for learning or practicing basic skills (83% compared to 61% for low-poverty schools).

In a multi-case study of three Los Angeles area high schools, Margolis (2010) found significant variation in the way that computer science was taught in schools. Based on extensive observations and interviews and focus groups with more than 200 students and teachers at the three schools, Margolis found that regardless of the kinds of technology available at a particular school, differences in the learning opportunities available to students were based on the racial and socioeconomic factors. While the highest-resourced school in the study offered a wide range of computing classes including an advanced placement computer science course, the lowest-resourced school, whose student population was 99% Latino/a, had an abundance of computers but "there were no classes that introduced the problem solving and scientific reasoning of computer science to allow students to more fully understand all that the field has to offer" (Margolis, 2010, Ch. 2, sec. 3, para. 4). Even at the highest-resourced school where two-thirds of the student population was bussed in from across Los Angeles, students in advanced courses were predominantly white and Asian.

As a result of this research, a university/K-12 partnership was founded to develop a more inclusive computer science curriculum and increase participation among women and students of color (Ryoo, Margolis, Lee, Sandoval & Goode, 2013). In the first four years of the program, enrollment in the Exploring Computer Science course jumped from 306 to 2136, with Latino/a students representing 70% of enrollment and African American students representing 9%. Programs have been developed across the country to encourage broader participation in computer science and STEM fields (e.g., Margolis, Goode & Chapman, 2015; Partovi, 2015; Wilensky, Brady & Horn, 2014).

Noguera, Darling-Hammond, and Friedlaender (2015) argue that all students should have access to deeper learning, focused on critical thinking and problem solving skills that help students learn to use information and knowledge to tackle real-world problems and develop new ideas and solutions. According to the authors, recent education policies focusing on high-stakes testing and tracking students into diverse curriculum tracks have exacerbated persistent inequalities in schools, with students of color and those from lower-income neighborhoods being most negatively impacted. Noguera et al. (2015) state,

The common situation in America is that schools in poor communities spend less per pupil—often many thousands of dollars less per pupil—than schools in nearby affluent communities. Underserved schools can't compete for the best teaching and principal talent in a local labor market and can't implement the high-end technology and rigorous academic and enrichment programs needed to enhance student performance.

To break the cycle of inequality in access to deeper learning that prepares students for college and work, the authors advocate for adequate and flexible funding to lower-resources schools, incentives to develop new school designs that incorporate deeper learning skills, new staffing models, and take advantage of technology and group learning, and resources for wraparound services such as early childhood education, mental health care, and summer learning opportunities (Noguera et al., 2015).

Information and communication technologies are also changing the teaching profession and placing new demands on teachers to gain expertise in various programs and applications as well as developing strategies for incorporating technology into curriculum and pedagogy. A national survey of nearly 2,500 Advanced Placement (AP) and National Writing Project (NWP)

teachers found that for 92% of participants the internet has a major impact on their ability to access content, resources, and materials for teaching (Purcell, Heaps, Buchanan & Friedrich, 2013). The majority also reported that the internet had a major impact on their ability to collaborate with other teachers (69%), interact with parents (67%) and interact with students (57%). At the same time, 75% of teachers reported that the internet and other digital tools added new demands on the range of content and skills they needed to be knowledgeable about for their profession, and 41% reported that these advances created more work in an effort to be effective teachers.

In a survey of 2,868 principals nationwide conducted by Project Tomorrow, a global educational nonprofit organization, 46% of participants reported that their school had implemented some form of blended learning and/or competency-based instruction with their students (Blackboard, 2016). Among those implementing blended learning, more than 60% cited benefits including extending learning beyond the school day, personalized learning for students, increased engagement among students. The vast majority – more than 80% in each category – of principals in the sample also articulated specific college and career ready skills that they felt were necessary for student success, including critical thinking and problem solving, ability to learn new skills independently and technology skills (Blackboard, 2016).

International Society for Technology in Education (ISTE), a non-profit organization supporting educators, has established standards for student technology use and skill development in schools (www.iste.org). The standards focus on four main areas: (1) creativity and innovation, (2) communication and collaboration, (3) research and information fluency, and (4) critical thinking, problem solving, and decision-making. According to the standards, students should be able to use technology to develop innovative products and processes, gather, evaluate and use

information, communicate effectively and collaborate with others, and use critical thinking skills to solve problems and conduct research. The standards set forth by ISTE, as well as those outlined by No Child Left Behind and the Common Core, provide a broad framework for best practices in teaching with technology. But they do not provide clear guidelines for implementation, and resources allocated to teacher training, technology infrastructure, and ongoing support are variable. Thus, it is not surprising that implementation is significant different across various contexts.

In a mixed-method study of three schools in California that implemented a one-to-one laptop program, Grimes and Warschauer (2008) found that while the laptop program led to limited changes to curriculum, there were major changes in content delivery in many classrooms. The two-year study included 554 seventh graders at a junior high in a low-SES community, 395 third-to-seventh graders at a new science and technology focused school in a high-SES community, and 62 third-to-sixth graders in the Gifted and Talented Education (GATE) program at an elementary school in an economically diverse suburban community. Grimes and Warschauer found positive changes in the areas of writing, information literacy, multimedia skills, and autonomy, with teachers reporting that students produced higher quality work, did more in-depth research, and worked harder on laptops. Students also reported high levels of satisfaction with the laptop program, but standardized test scores were mixed.

Laptop program students' English Language Arts (ELA) scores declined relative to their non-laptop peers, during the first year of the program and began to recover in the second, while math scores did improve in both years. Students at the low-SES school struggled the most, with ELA scores declining in the first year in comparison to the high-SES school. More than anything, this study, which used data from student test scores, observations, interviews, and

surveys, illustrates that test scores are not always the best indicators of technology integration and the ways that students are gaining 21st century skills. Grimes and Warschauer (2008) found that laptop use in the participating schools promoted national technology standards and students' development of 21st century skills, a finding that would not have been adequately captured with test scores alone. Without careful consideration and the use of effective policies, the growing reliance on ICT in schools has the potential to further marginalize students from lower socioeconomic backgrounds and leave many unprepared for the demands of higher education.

At this point, few would question that the vast majority of young people are active online and comfortable using basic ICT for communication and entertainment. According to a 2013 Pew Research Center report, 78% of teens have a cell phone and 93% own or have access to a computer at home (Madden, Lenhart, Duggan, Cortesi & Gasser, 2013). Young people from lower-income and lower-education households are still less likely to use the internet but mobile technology is beginning to level online access, with young people from lower socioeconomic backgrounds increasingly using their cell phone as a main point of entry. Using data from a national survey of 800 teenagers and their parents, Park (2015) found that parental income and education did not directly influence the teens' mobile phone use or skill. As the research on the digital divide has illustrated though, the challenge goes beyond providing equitable access to ensuring that all young people gain the necessary skills and expertise to support their academic and professional advancement.

In the following section, I will briefly discuss the ways that higher education is being impacted by advances in information and communication technologies, and the changing nature of professional work including, calls to prepare students for the demands of the 21st century workforce, the economic benefits of college, and students' transition to professional careers. An

overview of ICT usage and digital literacy among college students will be presented in a later section.

Higher Education and 21st Century Skills

In recent years, much has been written about the role and value of higher education in the context of a rapidly changing global economy and exploding college costs. Proponents point to the importance of educating global citizens (Nussbaum, 2002; Rhoads & Szelenyi, 2011), greater economic opportunities for graduates (Carnevale et al., 2010; Taylor et al., 2014), and the American ideals of innovation and creativity. At the same time, critics argue that students are not gaining the necessary skills for professional advancement (Heitner & Miller, 2010; Sitek, Claghorn, Docalovich, Feinstein, Ferraro, Larsen & Roy, 2012), are struggling to find good paying jobs (Arum & Roksa, 2014), and are sinking under massive loan debt (Carey, 2015; Denhart, 2013).

Views about the value of higher education are often complex and even conflicting. For example, a 2011 survey conducted by the Pew Research Center found that 57% of Americans believe that higher education fails to provide a good value for students and their families (Taylor, Parker, Fry, Cohn, Wang, Velasco & Dockterman, 2011). At the same time, 94% of parents surveyed expected their child to attend college and the majority of four-year college graduates reported that college was useful in intellectual development, maturation and personal growth, and career preparation. While some may be concerned about the tangible outcomes of college, enrollments continue to increase and the economic disparities between college graduates and those with less education become more substantial.

In a special report on universities in *The Economist*, Duncan (2014) states, "Higher education [in the United States] has a divided soul: it is both a great collective enterprise to

increase the nation's welfare and a fight to the death between status-hungry parents" (p. 16).

While the American higher education system is rooted in a desire to provide equitable opportunities for all students for the betterment of the society as a whole, growing stratification in the system has led to large gaps in college-going, retention, and the economic outcomes of graduates (Corak, 2013). Additionally, the digital divide does not disappear when a student transitions to higher education, and students with limited ICT experience may face greater challenges in academic courses and campus activities that incorporate the use of ICT and more advanced technical skills.

McClusky and Winter (2012) point to a shift in the higher education discourse during the past several decades from a focus on teaching to one of measurable learning outcomes. They argue that the "lecture-based, sage-on-a-stage teaching and learning modality is changing dramatically due to the digital revolution" (p. 20). Two-thirds of educational leaders in a national survey reported that levels of student satisfaction were similar for traditional face-to-face and online courses (Allen & Seaman, 2011), and an emerging body of research shows positive learning outcomes with the use of integrated technologies including student-response systems (clickers), social networking, blogs, online discussion boards, and discipline specific digital tools (Halic, Lee, Paulus & Spence, 2010; Ellison, Steinfield & Lampe, 2007; Martyn, 2007). Universities across the United States have initiatives designed to integrate these new pedagogical tools into courses, administrative systems, and student support services.

Economic benefits of college. Institutions of higher education serve many purposes, including creating new knowledge through research and development, educating the next generation of democratic citizens, and preparing graduates for professional career success. With regard to career preparation, colleges and universities have come under increased scrutiny in

recent years as some question whether or not new graduates have gained the necessary skills for the demands of the 21st century workforce. The question of whether college is worth it appears regularly in the popular media, with analysts arguing for and against college attendance using a range of data sources. As previously stated (Taylor et al., 2014), college graduates generally outperform their peers without a college degree on nearly every measure, from job satisfaction to annual income. Yet, these data can be complicated by further analysis of specific degrees, institution types, and the impact of student debt (e.g., Kaufman, 2015; Leonhardt, 2014).

Further, growing income inequality can negatively influence the impact of college degree attainment for some graduates. The college completion gap between students from low- and high-income families persists (Bailey & Dynarski, 2011; Corak, 2013), with numerous factors influencing these disparities, including access to information about college and financial aid (Fann, McClafferty Jarsky & McDonough, 2009; McDonough & Calderone, 2006; Venegas, 2006), learning activities and enrichment expenditures outside of school (Kaushal, Magnuson & Waldfogel, 2011; Phillips, 2011), and social networks that help some students find professional opportunities. Yet, while the challenges of providing equitable access persists, college is still viewed as a good investment by a majority of the population and national statistics confirm that college graduates are generally outperforming their peers with less education in the new knowledge economy.

A 2015 report from the Center on Education and the Workforce at Georgetown University found that good jobs, which the authors define as those in the upper-third by median wage of occupations in a given sector, have grown faster in the recovery than low- and middle-wage jobs (Carnevale, Jayasundera & Gulish, 2015). Further, the study found that 97% of these good jobs were filled by college graduates, and that the majority were concentrated in specific

sectors, including managerial/professional office workers, science, technology, engineering, and mathematics (STEM) fields, and healthcare professionals. Institutions of higher education have placed particular emphasis on supporting students in STEM fields in response to industry demands as well as federal interest and support. In 2012, the President's Council of Advisors on Science and Technology (PCAST) estimated the need for one million more STEM professionals to meet economic demand and called on colleges and universities to increase the number of undergraduate STEM degrees awarded annually by 34% (Holdren & Lander, 2012).

Preparing the next generation of professionals. Universities have responded to this growing demand for STEM graduates in diverse ways, from developing partnerships with industry, to focusing on active learning to bolster successful completion of core science and math courses, to engaging more students in undergraduate research experiences. In a national study of 2,873 students in 73 introductory STEM courses, Gasiewski, Eagan, Garcia, Hurtado, and Chang (2012) found that students were more engaged in introductory STEM courses that incorporated active learning pedagogies, including student response systems (clickers) and web-based pedagogy. These technologies encouraged communication and immediate feedback from instructors, which helped students to feel more engaged and willing to ask questions and get support both in and out of class.

Another national study of more than 4,000 aspiring STEM majors found that participation in undergraduate research was positively correlated with STEM graduate degree aspirations, college GPA, interaction with teaching assistants, and having a faculty mentor in college (Eagan, Hurtado, Chang, Garcia, Herrera & Garibay, 2013). Participating in undergraduate research will likely help students begin to see themselves as scientists, establish a mentoring relationship with faculty and graduate students on campus, and gain new skills and

knowledge to prepare for enrollment in graduate school. Villarejo, Barlow, Kogan, Veazey and Sweeney (2008) conducted a study of 322 alumni of an academic support program for biological sciences majors from underrepresented backgrounds to learn more about what college experiences influenced their career path. Findings from the alumni survey included in the study indicated that respondents (n=201) credited supplemental instruction in core science and math courses, academic advising, and participation in undergraduate research with supporting their academic success and persistence in a STEM career. Further, 70% of respondents (n=139) expected to follow a career in the biomedical professions, with three quarters choosing a clinical profession and one in five pursuing a science research career.

Beyond just STEM majors, institutions of higher education are increasingly interested in helping all students to explore diverse career options and develop skills and knowledge to support their transition to professional careers. Most colleges and universities encourage students to participate in job placements and internships, support student professional organizations, offer career planning and preparation at the department and institution level, and develop industry partnerships to help students gain information and experience related to local industry. Despite these efforts, some industry experts have voiced concerns about students not gaining the necessary skills to match the needs of the workforce.

College-to-career transitions of recent graduates. The American Society of Training and Development (ASTD) has voiced concern about a “skills gap” between the needs of a growing economy and the expertise and educational attainment of the current workforce since 2003 (Sitek et al., 2012). In a recent survey of members, who work in thousands of organizations of all sizes, ASTD found that 84% of respondents (n=377) reported that there was a skills gap in their organization, with middle- and high-skills jobs constituting the largest gap. Employers

reported challenges in both industry-specific skills (e.g., information management, web design, networks/infrastructure) and critical soft skills such as communication, collaboration, creativity, and critical thinking.

In their study of more than 900 employers and workers across sectors, Heitner and Miller (2010) found differences in workers' perceptions of their skills related to working independently, in teams, and in a multicultural environment compared to employers' ease of finding employees who had these skills. Further, there were discrepancies related to degree attainment with employers more likely to rate the demand for bachelor's and master's degrees in their organization and sector as moderate or high than employees. Finally, employers reported that it was currently "very difficult" to find workers who can "think critically, solve complex problems, and communicate clearly in written and oral formats" (Heitner & Miller, 2010, p. 47). Based on study findings, Heitner and Miller assert that employers are much more aware of future labor market demands than workers, with regard to postsecondary education, skills, and ongoing training.

In a global labor market characterized by rapid technological advances and shifting industry demands, institutions of higher education are an important component of filling the skills gap and preparing graduates for professional success. College graduates are twice as likely to receive further training from their employers to encourage job growth and long-term career success (Carnevale et al., 2010). In addition, highly educated workers use computers and automation in the workplace in ways that enhance their productivity and autonomy, while less-educated workers tend to use these tools as a substitute for skills. As Carnevale et al. state, "Higher levels of formal education not only increase access to jobs that provide further training, they also increase access to technology that complements, rather than replaces, skills" (2010, p.

2). According to the authors, effective use of technology at work is linked to better pay and benefits, workplace training, and long-term professional security.

Yet, many employers do not believe that colleges and universities are doing enough to prepare graduates. A survey of 302 employers conducted for the Association of American Colleges and Universities in 2010 found that only one in four respondents felt that colleges were doing a good job of preparing students for the global economy (Hart Research Associates, 2010). Employers in this study felt that students needed to be prepared with a combination of liberal and applied learning because the challenges and expectations facing employees today are more complex than those in the past. More than 80% of respondents also wanted students to complete a major project before graduation to demonstrate analytical, problem-solving and communication skills, complete an internship or community-based field project to gain real world experience, and develop research skills, all to help prepare them for future success.

In their book, *Aspiring Adults Adrift: Tentative Transitions of College Graduates*, Arum and Roksa (2014) followed up with more than 900 recent graduates who had participated in their previous study of college students. The study used data from surveys conducted one and two years after graduation (spring 2010 and 2011) and interviews with a subset of 80 graduates. As the book title suggests, Arum and Roksa argue that recent college graduates are struggling both personally and professionally to transition to adulthood, in part because of limited academic learning in college and an overemphasis on socializing and the development of interpersonal skills. They found that more than half of college graduates who hadn't returned to school full time were either unemployed, employed in part-time positions, or had full-time jobs that paid less than \$30,000 per year. In line with previous research, employment and wages varied based

on academic major and college selectivity with business majors having lower rates of unemployment and engineering students earning higher salaries on average, for example.

While many of these students struggled to find good jobs in a tough economy still recovering from the recession, they reported using a wide range of strategies including institutional resources such as career centers and job fairs, connections from internships and former employers, and personal networks for friends, relatives and other contacts (Arum and Roksa, 2014). Further, when asked whether college was relevant to their careers most graduates reported that college had given them a range of career-relevant skills, and they linked the acquisition of both general academic and career-specific skills as well as interpersonal skills to their post-college success. Arum and Roksa are not surprised that graduates would have positive feelings about college considering their significant investment of time and resources. Based on their findings, they also challenge educators to “take advantage of digital technologies to better implement ‘connected learning’ pedagogies” and find ways to ensure that students see the relevance of their education for their futures (ch. 5, sec. 2, para. 5).

All of these studies point to the challenges faced by new college graduates of leveraging the skills and expertise they develop in college to successfully transition to the professional workforce. Despite the variations in definition and standards, there is broad consensus that young people and college graduates need to gain a range of 21st century skills that includes ICT skills. Employers expect new graduates to have these broad skills along with industry-specific competencies to help them successfully transition to work and thrive in a professional environment dependent on advanced ICT. Being confident in one’s ability to utilize ICT to enhance professional work is an essential skill in today’s workforce. With the rapid pace of

technological advancement, new professionals must also be able to adapt and grow as industries change, technologies advance, and work arrangements become increasingly fluid.

Part II. Literacy and Learning

Literacy has always been an important component of learning and social engagement. Yet, notions of literacy have changed substantially over time. In the following section, I will provide a brief discussion of the changing views of literacy from traditional notions of literacy to more modern ideas about new literacy practices. I will then outline Martin's (2008) conceptual framework of digital literacy that will guide this study, followed by a brief discussion of college students' use of information and communication technologies, and development of digital literacy for academic and professional purposes.

Traditional Notions of Literacy

Since the Middle Ages, literacy has generally been conceived as the ability to read and write, and participate fully as a learned member of one's community (Martin, 2006). It has often been characterized as a singular competence or ability that confers legitimacy and capital to its owner (Goodfellow, 2011). Literacy has always carried with it a certain level of status and privilege, even as the ability to read and write expanded to the majority of the world's population. For some, including Freire, these are more than specialized skills but a vehicle for emancipation, democracy, and social justice (Freire and Macedo, 1987; Freire, 2000). Beyond learning to read and write, literacy encompasses a critical awareness of social inequality and oppressive practices, and encourages resistance. Gee (2008) argues that

The most striking continuity in the history of literacy is the way in which literacy has been used, in age after age, to solidify the social hierarchy, empower elites, and ensure

that people lower on the hierarchy accept the values, norms, and beliefs of the elites, even when it is not in their self-interest or group interest to do so (p. 31).

He points out that the term literacy has been used to distinguish different groups of people, with literate people being characterized as more intelligent, modern, moral, and advanced despite little historical evidence to support these claims.

The term has also been used to delineate "illiterate" adults who need additional training to gain new skills for personal and professional advancement (Lankshear & Knobel, 2003). Similarly, development organizations, such as the Organization for Economic Cooperation and Development, often consider a country's adult literacy rate as a measure of progress and economic advancement (OECD, 2013). This deficit model of literacy has persisted and much attention is now focused on remediating individuals deemed to have insufficient literacy skills (Martin, 2006).

Fears of a literacy "crisis" in the 1970s, fueled by changes to the U.S. post-industrial economy, was one of several factors that changed the landscape of literacy education in schools throughout the country (Lankshear & Knobel, 2003). Calls for school reforms were widespread with a particular focus on making sure that all students were ready for the demands of the 21st century society and workforce. Further, the shift toward socio-cultural theories of literacy helped to change the language of formal education from a focus on reading and writing to the development of literacy. Claims of a reading crisis (Chall, Jacobs, Baldwin & Chall, 2009; National Institute of Child Health and Human Development, 2000) led to debates about the proper ways to teaching children to read and write. Yet, as Gee (2004) points out, the majority of children who fall behind in gaining these literacy skills in schools are poor or come from racial and ethnic groups whose members have faced a history of prejudice and oppression. Gee argues

that this literacy gap is better understood by considering the difficulties of mastering "academic specialist varieties of language" that are integrally connected to complex and technical ways of thinking, and that privileged children from educated, financially stable homes often have greater access to a wide range of resources outside of school (2004, p. 17).

For Gee, children are successful in learning to read when the experience is connected to their home life and community context. From this view, students who connect learning to their personal identity, whether learning to cook or tackling physics, are more engaged in the process and master these skills on a deeper level. Therefore, many students who do not feel like they belong to or are valued by the dominant social group in schools, or who view teachers and schools as hostile or oppressive to their home-based identities, will struggle.

Redefining Literacy as a Social Practice

During the 1980s and 1990s, sociocultural perspectives of literacy from various fields gained prominence (Lankshear & Knobel, 2003). From this viewpoint, literacies are embedded in social practices and are therefore constantly evolving to meet the needs of contemporary life (Gee, 2008; Leu et al., 2004). More than a simple set of skills to be gained, they involve applying specialized knowledge for particular purposes in varying contexts. Literacies are "bound up with social, institutional, and cultural relationships, and can only be understood when they are situated within their social, cultural, and historical contexts" (Lankshear & Knobel, 2003, p. 8).

Therefore, literacy is connected to social identity and an integral part of the everyday experiences of individuals engaging in oral, written, and computer-mediated interactions.

Scholars working with the broad framework of sociocultural studies of literacy, sometimes referred to as New Literacy Studies, believe that literacy is a set of social practices and that there are different literacies associated with the various domains of people's lives. From

this view, a person might identify as a student in one setting, an employee in another, a parent or family member in another, a gamer in another, and so on. Their identity in specific contexts will likely influence their literacy practices – the language and expressions they use, the formality of their speech patterns, and their use of certain skills and competencies.

Gee (2004) characterizes these diverse literacy practices in terms of specialist languages tied to socially situated identities and activities. Gee argues that academic specialist language has been used as the standard measure for success in school and society. Yet, with the changing economy and technological advances this form of language “is now at best a *necessary, but not sufficient* condition for success” (2004, p. 94). Gee critiques the new capitalism of hyper-competition for markets and overproduction of commodities, and argues that security in this new economic environment is no longer rooted in jobs and wages but in what he calls one’s portfolio. To succeed, individuals must develop a “shape-shifting portfolio” made up of skills, experiences, and achievements that can be rearranged and repackaged at any time to meet changing demands (Gee, 2004, p. 105).

While formal education has historically been a main driver of personal and professional advancement, Gee (2004) argues that Millennials increasingly see schooling as a necessity in terms of credentials and signaling status, but they realize that many of the diverse skills and experiences they need for success will be gained at home, through social activities and networks, and in online spaces. He argues, “In the new capitalism class is defined by the nature of one’s portfolio, the sorts of experiences, skills and achievements one has accrued (which one shares, by and large, with the ‘right’ sort of people) and one’s ability to manage these in shape-shifting way” (2004, p. 106). While Gee recognizes factors such as income and race as factors in the

development of one's portfolio, he feels that young people must see themselves as free agents who define their own trajectories and level of success.

New Literacies, Multiliteracies and Digital Literacy

In the context of the rapid expansion of personal computing, the internet, and other ICT in the last several decades, researchers began to ponder the ways that these new digital technologies were influencing language and literacy practices (Belisle, 2006; Coiro, Knobel, Lankshear & Lue, 2008). While some scholars envisioned major changes to social practices, others questioned whether these technologies actually required anything new with regard to literacy. Leu et al. (2013) argue that literacy has never been static because, "Social contexts have always shaped both the function and form of literate practices and been shaped by them in return" (p. 1151). They highlight several social forces that are influencing the changing nature of literacy, including global competition in economies dependent on the effective use of information and communication, widespread use of the internet among young people in the United States for both academic and personal purposes, and changes to professional labor in post-industrial economies.

While new literacies build upon traditional literacy practices such as word recognition, vocabulary, and cognition, Leu et al. (2013) argue that these skills will not be adequate as communication takes on new forms and functions. These technologies require new skills, strategies, dispositions, and social practices to realize their full potential. Further, these new forms of networked information and communication can create challenges for comprehension and accuracy that require new strategies for optimal use. Leu et al. (2013) point to the effective use of information to solve problems and the changing nature of literacy within organizations. Specifically, they identify literacy skills needed by workers in the knowledge economy

including, the ability to identify problems, locate useful information, critically evaluate and synthesize information from multiple sources, communicate solutions across the organization, and evaluate procedures for effectiveness and future modifications.

Literacy practices are constantly changing and are also influenced by the tools and contexts in which they are utilized (Leu et al., 2004; Wilber, 2008). Further, the line between students' use of ICT for academic, professional, and personal purposes is often difficult to distinguish and it is therefore instructive to consider new literacy practices from a broad perspective. Individuals construct new visions and possibilities for technological advancement through ongoing interactions, and subsequently share these plans with others and develop complementary social practices (Leu et al., 2013). Lankshear and Knobel (2003) refer to ontologically new literacies as changes to the "character and substance of literacies" based on rapid changes in ICT, the media, and the global economy (p. 16). They argue that these changes influence social practices in all areas of life, and ultimately alter the way individuals communicate and share information.

Defining Digital Literacy

A variety of terms and definitions have been applied to articulate the range of essential skills and competencies needed to navigate the "accelerated, media-saturated and automated" modern society (Jones-Kavalier & Flannigan, 2006, p. 8). Gilster (1997) defined digital literacy as "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p. 1). Before Gilster, the term digital literacy had only been used to discuss specific technical skills on the computer without any reference to traditional notions of literacy (Bawden, 2008). For Gilster, digital literacy was "more a matter of concepts than keystrokes" (p. 30). Some of the major components of digital literacy presented by

Gilster included: the ability to assemble knowledge from different sources, critical thinking skills and wariness of sources, an understanding of non-sequential information, an awareness of the value in merging digital and traditional formats, the ability to filter information, the ability to publish and communicate in digital formats (Bawden, 2008).

Today, the term digital literacy is "situated in a web of literacies" (Lankshear & Knobel, 2008). ICT, computer, information, technology, and media literacies have all been used in various ways to discuss the demands of the digital age, with some having more narrow definitions than others. A number of scholars, including Lankshear and Knobel (2008), advocate for a pluralistic understanding of digital literacies, based on the diversity of accounts and research related to these issues, the benefits and usefulness of a socio-cultural perspective, and the opportunity for synergy among perspectives. Jones-Kavalier and Flannigan (2006) argue that variations in terminology and redundancies can be explained by "the newness of the phenomenon... the lack of extensive or at least longitudinal research related to digital literacy and, most importantly, to its impact on the learner" (p. 9). Further, the debate about the benefits and challenges of computers and ICT for social, political, and economic advancement has not been fully resolved.

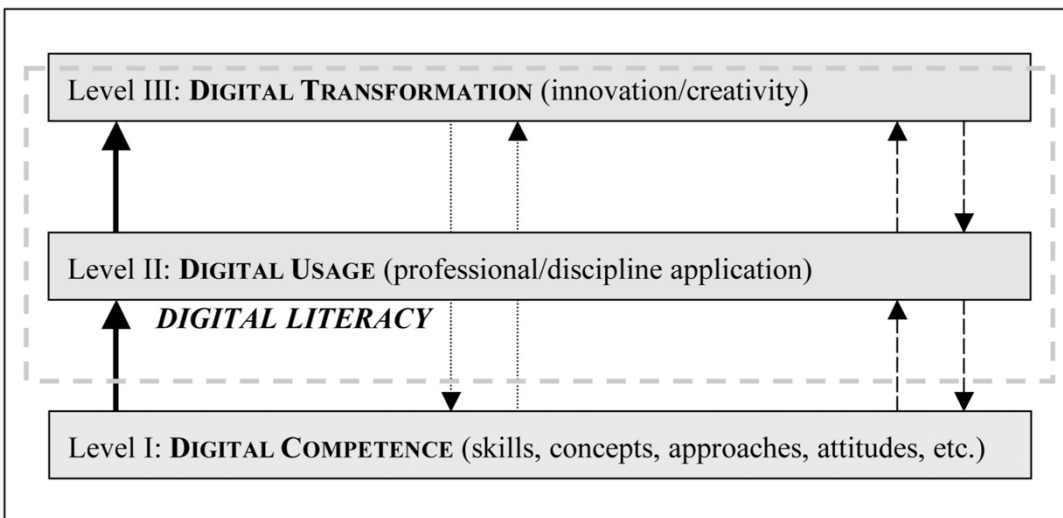
Two major categories have emerged with regard to defining digital literacy: standard operational and conceptual definitions (Lankshear & Knobel, 2008). Operational definitions of digital literacy seek to determine the specific skills and abilities needed to complete certain tasks related to computers and ICT. In contrast, conceptual definitions of digital literacy are more interested in understanding the broader context of such literacies and emphasize mastery of ideas, careful evaluation, intelligent analysis, and critical reflection. Martin (2008) provides a conceptual definition of digital literacy that considers both the necessary foundational skills and

one's ability to utilize these skills for various purposes. It recognizes the importance of social practices in shaping attitudes and behaviors, and the multiple ways of understanding learning, meaning-making, and communication in a digital world.

Martin (2008) defines digital literacy as, the awareness, attitude, and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon the process.

Martin provides a conceptual framework for understanding digital literacy that includes three levels: digital competence, digital usage, and digital transformation (see Figure 1). For Martin (2008), digital competence encompasses a wide range of topics and skills from basic recognition of digital tools to more critical and conceptual understandings. Individuals will draw on these competencies as needed to complete tasks relevant to their own lives and will continually gain new skills based on personal and professional demands. Martin articulates 13 processes of digital competence including identification of the necessary digital resources, analysis of various information and resources to solve problems, and the ability to communicate and disseminate relevant output and solutions to various audiences (Appendix A). Yet, for Martin, acquisition of these digital competences is merely a precursor to the development of digital literacy.

Figure 1. Martin's (2008) Conceptual Framework for Digital Literacy



Digital usage, the second level of the framework, involves the application of digital competence by individuals and groups within specific domains, such as professional, disciplinary and community arenas (Martin, 2008). Individuals become part of a "community of practice," as advanced by Lave and Wenger (1991), made up of individuals with shared concerns and problems who advance knowledge through collaborative interaction. Appropriate usage of digital competence is informed by knowledge and expertise of the relevant domain. Therefore, digital usage involves "informed use of digital competence within life-situations" to address challenges and complete tasks, which in itself will trigger further action and discovery (Martin, 2008, p. 173).

Finally, digital transformation is "achieved when the digital usages which have been developed enable innovation and creativity and stimulate significant change within the professional or knowledge domain" (p. 173). Martin (2008) argues that digital transformation is not a necessary condition of digital literacy, and that informed and appropriate usage of digital

competence situated in relevant domains is adequate. Further, he argues that digital literacy is an element of individual identity that is constantly evolving and changing based on social context.

This framework is particularly useful for considering the ways in which college students gain the necessary skills and competencies to navigate academic and professional spaces in a digital world. It encompasses both the acquisition of the requisite skills of digital literacy but also points to a broader understanding of the ways that these skills can be used in context. While the majority of college students are able to use computers and other digital devices for everyday communication, entertainment, and basic information gathering, it is important to gain a deeper understanding of the ways that these students acquire the necessary skills to engage in academic and professional communities of practice. Martin's framework highlights the difference between basic and applied usage of computer and ICT skills.

One of the limitation of Martin's (2008) framework is its limited focus on critical literacy. Among the 13 processes of digital competence in the model are the abilities to access, evaluate, interpret, and organize digital resources. While the inclusion of these skills recognizes the overwhelming abundance of information sources that individuals must navigate to find appropriate and useful resources, the model does not address the power structures that influence media messaging, online search engines, and information management. Critical literacy is a central feature of new literacies. Open online networks and the sheer magnitude of information means that students must learn to be critical consumers of information from a wide range of sources (Leu et al., 2013). At the same time, a deep analysis of students' level of critical literacy is beyond the scope of this study, and as such, will focus primarily on digital literacy skills as they relate to students' preparation for professional career transitions.

College Student ICT Usage and Digital Literacy

American college students, many of whom are considered Millennials, are often characterized as “digital natives” and “early adopters” who are comfortable navigating the rapid pace of technological innovation. They have grown up in a world of constantly flowing news and information saturated by computers, the internet, and a wide range of other information and communication technologies from Facebook to the cloud to Wikipedia. A majority of young people now have a mobile smart phone which allows them to communicate via phone, email, photos, and countless applications, use mapping services to navigate their world, and search for information with their fingers and their voice. College campuses have also become hubs of technological advancement, with smart classrooms, secure networks, and WiFi access throughout as well as every imaginable device and application to meet the needs of researchers across disciplines.

Much of the research on college students’ use of ICT has focused on the effective integration of digital technologies across the university and particular components of campus life (e.g., Gikas & Grant, 2013; Owen & Demb, 2004; Salmon, 2005), differences in ICT usage based on demographic characteristics such as gender and race (e.g. Cotton & Jelenewicz, 2006; Wentworth & Middleton, 2014; Wohn & LaRose, 2014), the expansion of online education (e.g., Parker, Lenhart & Moore, 2011; Shea & Bidjerano, 2014), and the use of a specific device or application in college courses (e.g., Biddix, Chung & Park, 2015; Caldwell, 2007; Dahlstrom, Brooks & Bichsel, 2014; Reimer, Schenke, Nguyen, O’Dowd, Domina & Warschauer, 2016). In a review of current literature, Wilbur (2008) asserts that the systemic research on college students’ everyday practices with digital technologies are surprisingly limited, especially in comparison to studies of school-aged children.

According to the Pew Research Center, nearly all (99%) of 18-29 year olds are internet users (2017a) and 86% use at least one social media site (2017b). More than half (56%) of 18 to 29-year-old smartphone owners use auto-delete messaging apps such as Snapchat and Wickr, compared to only 13% of 30-49 year olds (Greenwood, Perrin & Duggan, 2016). LinkedIn, a popular professional networking site, is used by 34% of 18-29 year olds, and is particularly attractive to college graduate (50%) and higher-income individuals (45%; Greenwood et al., 2016). In a study of 48 college students that tracked daily usage, participants spent, on average, an hour and a half on social media sites daily, and visited these sites 118 times throughout the day (Wang, Niiya, Mark, Reich & Warschauer, 2015).

The Educause Center for Analysis and Research conducted a study of undergraduate students and information technology using data from a sample of 71,641 students at 183 institutions (Brooks, 2016). According to the study findings, students were generally a had positive attitude toward information technologies (IT) and reported high levels of IT usage. Two-thirds of students reported using their laptop for all of their courses, and 93% of respondents said that their laptop was “very or extremely important for their academic success,” (Brooks, 2016, p. 13). The majority of respondents felt like information and communication technologies supported collaborative learning with their peers, and more than 70% reported that these tools helped them engage with course content by facilitating research for class assignments, investigating topics outside of class, and analyzing data (p. 26). At the same time, nearly 40% of students were distracted during class by digital activities such as texting and reading emails. Students viewed information and communication technologies as “a set of skills or literacies they are expected to possess,” and 27% of students reported that they would like to have been better prepared to use basic software programs and applications when they entered college, (Brooks,

2016, p. 21). Additionally, 39% reported wanting to be better prepared to use institutionally specific technology such as learning management systems and library resources.

In a national study including data from 29 two- and four-year colleges and universities, Jones, Johnson-Yale, Millermaier and Perez (2009) found that the majority of college students felt that the internet had a positive impact on their college experience. With regard to academic internet use, 40% of African American and white students reported communicating via the internet with their professors about once a week, whereas 26% of Hispanic students reported this same level of activity. At the same time, Hispanic student reported communicating with their classmates more frequently, with nearly 50% saying they connect with classmates online several times per week.

Numerous studies have also looked at the impact of digital activities such as cell phone, texting, email, and social media usage on academic performance, stress, and anxiety among college students. In a study of 483 undergraduates at a private university in New Jersey, Wentworth and Middleton (2014) found a small but significant negative relationship between students' computer use and their college GPA, and a significant negative relationship between the amount of time spent on the computer per week and hours spent studying. Lepp, Barkley and Karpinski (2014) examined the relationship between students' academic performance, anxiety and satisfaction with college life using a sample of 536 undergraduate at a large public university in the Midwest.

Their findings indicated that students' frequency of cell phone usage was negatively correlated with GPA and positively related to anxiety, while GPA was positively related to satisfaction with college and anxiety was negatively associated with this outcome. Mark, Wang and Niiya (2014) also found that multitasking online and frequency of computer usage were

positively related to college students' stress levels. In an observational study of 48 students that measured actual computing behavior over the course of a week, the researchers found that students' stress levels increased throughout the day as computer usage increased, but that activity on social media such as Facebook lowered their stress. While these single institution studies cannot be generalized to all students, the results indicate that more research is needed to understand the ways that college students manage their frequent computer and online engagement.

As these studies suggest, college students, and Millennials in general, spend a significant portion of their day online or engaged in other digital activities. It is not surprising then that this group also receives much of their news and current events online and through social media. Students in college also consume news and media predominantly through the internet and often hear about news first through social media (Rosengard, Tucker-McLaughlin & Brown, 2014). Based on a national survey of 1,045 young adults ages 18 to 34, the Media Insight Project (2015) found that 69% of respondents seek out news at least once a day, and when they search online to learn more the majority (57%) want the destination to be a source they know well, and the site to offer ample references and links (52%).

Eighty eight percent of respondents get news from Facebook regularly and nearly 90% feel that they encounter diverse opinions when they access news through social media. A big data study of individuals' exposure to diverse news on Facebook challenges this assumption among participants that news on social media provides access to diverse viewpoints. Using data from more than 10 million U.S. Facebook users, Bakshy, Messing and Adamic (2015) found that individuals' friends and contacts on social media, which they personally select and manage, influence the level of cross-cutting content to which they are exposed on a regular basis. The

authors make the point though that individuals do not necessarily encounter information at random in offline environments either or through online search engines, which use sophisticated algorithms based on a range of preferences and demographics.

The pervasiveness of computers and ICT is also impacting the way college students gather information about jobs and network with potential colleagues and employers. Puckett and Hargittai (2012) used a sample of 1,060 college students at the University of Chicago to learn more about the ways that personal background, internet skill and experience, online social network behaviors (building and bridging relationships), and access to other sources of information would influence the choice to use the internet for job-seeking purposes. They found that African American, Asian American, and some groups of ESL students were significantly more likely to use the internet for job-seeking purposes as compared to white students. Puckett and Hargittai hypothesize that these results might indicate “greater use of the internet among those who may have fewer institutional ties to jobs and careers” (p. 99). There were no differences based on racial, ethnic, or language backgrounds for other sources of information, such as family and friends, professors, career counselors, and media sources, which further supports the idea that the internet might provide a source of more comprehensive information about job opportunities for certain groups of students.

Literacy practices are constantly changing and are influenced by the tools and contexts in which they are utilized (Leu et al., 2004). The line between students’ technology usage for academic, professional, and personal purposes is often difficult to distinguish (Wilbur, 2008), and it is therefore instructive to consider new literacy practices from a broad perspective. It is also important to learn more about the ways that college students are navigating this constantly changing technological landscape and preparing for the technology demands of their professional

careers, especially in a time when college students' academic abilities and learning in college have been questioned (e.g., Arum & Roksa, 2010; 2014).

CHAPTER 3: METHODOLOGY

As the previous chapters have discussed, information and communication technologies (ICT) have greatly influenced perceptions of literacy, student learning and communication, and the world of professional work. Social and economic forces also help to shape students' interactions with the internet and other ICT, and perceptions of their utility for academic and professional pursuits. With the preceding in mind, this study seeks to understand what opportunities and experiences influence the development of high levels of digital literacy among college students, and how the acquisition of these skills helps graduating students prepare for professional careers. This chapter is divided into two main parts. I begin by presenting the theoretical framework that guides the study. Next, I provide a detailed description of the research design and methods that were used to carry out this explanatory sequential mixed method study.

Part I. Theoretical Framework

Two theoretical frameworks were used to guide the study – one focused on digital literacy and the other on career development. To facilitate the exploration of college students' acquisition and usage of digital literacy, I used situated learning theory (Lave & Wenger, 1991) and Sims's (2014) concept of differentiating practices. This theoretical approach recognizes social practices and power relations as influencing the development of digital inequalities, and seeks to gain a deeper understanding of how individuals navigate these social forces to acquire digital literacies for various purposes. Building upon this theoretical grounding, I utilized the theories of boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999) to consider the ways that students conceptualize and prepare for the transition to work after college, from developing strong goals (knowing why) to cultivating the necessary

skills and an understanding of employer expectations (knowing how) to leveraging their personal network to find opportunities (knowing whom).

Differentiating Practices and the Development of Digital Literacy

Throughout the past several decades, significant research has been devoted to understanding differences in access to and usage of digital technologies based on a wide range of factors from gender to race to geography. As the literature chapter discussed, the concept of the digital divide has progressed from an oversimplified binary of haves and have-nots to a more nuanced examination of differential usage. Several factors seem to influence ICT usage and the development of digital literacy, including specific skills and competencies, and cultural or technical capital (e.g., DiMaggio et al., 2004; Mossberger et al., 2003; Warschauer, 2004). As public policy efforts, corporate competition, and the lower cost of devices brought about greater equity in basic access to computers and the internet, scholars of digital inequality examined additional factors influencing differential usage, including the quality of access and autonomy of use.

DiMaggio et al. (2004) advocate for a research agenda that move beyond the binary view of the digital divide by “identifying critical dimensions of inequality, documenting differences among groups; explaining the antecedents of inequality on these dimensions; and modeling the relationship among different forms of inequality and between these and critical outcomes” (p. 28). They focus on five broad forms of inequality with regard to technology including, technical means (hardware, software, connections), autonomy of use, skills, social support, and purposes for which people use technology. DiMaggio et al. argue that inequality in access to and usage of ICT is a “systematic source of social inequality” (2004, p. 53) and will have lasting consequences without significant attention and intervention.

While the scholarship on differential usage of digital technologies does offer a more refined examination of disparities, Sims (2014) argues that there are significant limitations to the concept for explaining digital technologies and social inequality. He proposes a theoretical shift to the concept of "differentiating practices," which emphasizes "negotiations over legitimate participation in social practices [that] often help make and mark salient social differences and identities for those involved" (Sims, 2014, p. 671). By focusing on social practices, Sims seeks to highlight the role of ICT in reinforcing historically situated social divisions.

The concept of differentiating practices is grounded in theories of practices, in which scholars such as Ortner (1984) and Bourdieu (1977) examined the relationship between objectivism and subjectivism and argued that individuals play an active role in shaping their world while also being shaped by their social interactions (Sims, 2014). According to Sims (2014), "Since the practices that persons participate in have been historically structured, participation is simultaneously structured and structuring, partially determined and partially determining, but never closed off to change" (p. 675). Participation in social relations often involve struggles for legitimacy, conflicts, and contradictions, and these in turn influence social positions and identities. Social identities are then constructed through legitimate participation in socially and culturally situated activities.

From this perspective, technology usage is embedded in collective social practices and individuals develop digital literacy through these ongoing interactions. Sims (2014) uses the concepts of "legitimate peripheral participation" and "communities of practice" to consider the ways that individuals gain new skills and competencies for personal advancement. Situated learning theory (Lave, 1991; Lave & Wenger, 1991) draws on both cognitive and social constructivism and is based on the idea that "learning, thinking and knowing are relations among

people engaged in activity in, with and arising from the socially and culturally structured world” (p. 67). From this view, individuals are engaged in communities of practice, and move from peripheral participation to a more engaged, central position as their expertise and connection to the community increases. Through legitimate peripheral participation, newcomers learn from more advanced practitioners and, as they gain skills and expertise, move away from the periphery toward full participation in the community of practice (Lave and Wenger, 1991). Pedagogy is grounded in real world contexts and instructors focus on mentoring and coaching to encourage exploration and reflection among participants.

For Sims (2014), this concept can be applied to digital literacy in the sense that individuals learn specialized skills through legitimate participation in different communities of practice. With regard to digital technologies, individuals will learn to match strategies and particular uses with goals and desired outcomes, and will become familiar with those practices that are considered beneficial and legitimate in a particular community of practice. The concept of differentiating practices, informed by Lave and Wenger's (1991) notion of legitimate peripheral participation, is therefore useful in considering what factors influence the development of digital literacy among college students. According to this model, a wide range of factors, from family dynamics to schooling to peer groups, will likely influence the development of digital literacy. Plus, with the deictic nature of new literacies, opportunities to gain new skills and join a particular community of practice will continue to present themselves throughout college and into one's professional career.

Boundaryless Careers

Careers are often viewed as a series of work experiences that change and evolve over time (Arthur, Hall, & Lawrence, 1989). Much literature on career development has focused on

the organization and its management of workers to encourage productivity, innovation, adaptability, and collective competencies (e.g., Mahmood & Mann, 2005; Masi & Cooke, 2000). The idea of stable bureaucracies where expertise is housed within the organization has been prevalent in the literature and collective consciousness since the industrial revolution. Yet, new notions of professional careers have taken root as digital technologies have influenced communication and information sharing, created new sectors within the global economy, and facilitated the growth of distributed workforces.

As the literature suggests, new college graduates are entering a labor market where insecure and temporary work arrangements are commonplace, employers demand a wide range of skills and field-specific expertise, and employees must be willing to engage in ongoing professional training to maintain and gain relevant skills. The theory of boundaryless careers is rooted in the notion of careers as a journey of individual exploration, enactment, and the creation of personal meaning (e.g., Weick, 1995; Wheatley, 1992) where individuals cross many professional employment boundaries during their working lives (Arthur et. al., 1999). The concept encompasses a wide range of professional border-crossings, including workers who transition between separate employers, skilled workers – such as academics or carpenters – who gain marketability through channels outside of their present employer, professionals dependent on external networks such as real estate agents or consultants, and careers that do not conform to traditional notions of hierarchy and advancement (Arthur & Rousseau, 1996).

Few workers will gain career advancement at a single company or organization, and therefore their professional identities will encompass a wide range of experiences and interactions beyond the formal organizational structure. Arthur and Rousseau (1996) point to the dissolution of many traditional corporate boundaries such as “hierarchy and status, occupational,

trade and job boundaries of specialist skill and function, and social role boundaries separating work considerations from those of family and home" (p. 11). As the literature discussed, work arrangements have become less reciprocal and secure in many fields, with project-based work, contract assignments, and temporary status on the rise. As workplace boundaries dissolve and employers provide workers with fewer opportunities for long-term career security, individuals must be strategic in finding ways to advance their own careers.

Employees can no longer afford to focus on supporting a particular organization throughout their career in the hopes of gaining ongoing advancement and accrual of benefits. Instead, workers can accumulate a range of benefits from each new professional experience that will inform future choices and actions, such as specialized skills and expertise and social networks. While all decisions are not necessarily strategic in the sense of advancing one's career, they all contribute to the overall story of a person's professional life.

The concept of boundaryless careers focuses on the individual, as opposed to the organization, and the development of know-why, know-how, and know-whom competencies (DeFillippi & Arthur, 1994). These career competencies, or "three ways of knowing," are assets that individuals develop throughout their careers that enable them to engage and advance in the knowledge economy (Inkson & Arthur, 2001, p. 51). The idea of knowing-why is, "the energy, sense of purpose, motivation, and identification with our work that we bring to our careers" (p. 51). This sense of purpose is not static and may change throughout the course of one's career as maturity, experience, and new skills influence a person's circumstances and professional aspirations.

Knowing-how competencies are the skills and expertise that we accumulate during our careers, from career-specific skills to tacit knowledge about one's field and professional

environment (Inkson & Arthur, 2001). These competencies may include technical, interpersonal and conceptual expertise, and may be organization-specific or transferrable across organizational settings. Finally, knowing whom competencies include the relationships, reputation, and sources of information that one accumulates through work. These career networks often include a wide range of personal and professional contacts with varying levels of familiarity and influence, and are often maintained through online communication and social networking.

According to DeFillippi and Arthur (1994), the value of these career competencies for professional growth and advancement is realized when they are enacted in settings that recognize an individual's potential contribution and provide opportunities for further development. In a knowledge economy focused on innovation and technological advancement, educated workers with specialized skills are sought after to advance organizational objectives. The goal is to "optimally cultivate and leverage the firm's knowledge-based core competencies, which largely reside in the intelligence (know-how), motivation (know-why), and information networks (know-whom) of the firm's workers" (DeFillippi & Arthur, 1999, p. 311). While not all companies value their employees in this way, firms who target and hire workers with specialized skills often provide benefits and opportunities to their employees that help to create a more mutually beneficial working relationship.

While this dynamic may be beneficial for highly skilled workers whose specific knowledge has high market value, this can also create challenges for new professionals such as college graduates who need to grow their skill set through stable work experiences. Further, for some college graduates it takes time to settle into their career path for a variety of reasons, including trouble finding a job in their field, uncertainty about their career goals, and the struggle to identify their abilities and interests related to work (Murphy, Blustein, Bohlig & Platt, 2010).

College students who begin to articulate their career goals, develop digital literacy and other career-relevant skills, and build a network of professional contacts during their undergraduate experience will likely be more confident when they graduate and start looking for professional opportunities.

The Accumulation of Career Capital

Career competencies of know-why, know-how, and know-whom are interdependent forms of career capital that accumulate through educational, professional, and life experiences (Arthur et al., 1999; Inkson & Arthur, 2001). These assets are constantly evolving and develop throughout an individual's career as new experiences and interactions influence their decisions to pursue opportunities for growth within an organization, prioritize family above career for a period of time, or utilize their skills and expertise to start an independent business venture. Gaining new career capital is not guaranteed with each new professional experience, and some jobs may actually deplete an individual's capital as their particular skills become less valuable over time. "People relying on a particular trade, degree, or professional certification, or on a company promising lifetime employment, may see their stock of career capital much diminished unless they take continuous steps to sustain in" (Arthur et al., 1999, p. 126). Further, some forms of career capital are valued above others, such as those developed in formal work settings as compared to the managerial skills developed while running a home or caring for family.

Boundaryless careers are characterized by the accumulation of career capital through the exchange of reciprocal benefits between career actors and employers (Arthur et. al., 1999). As Inkson and Arthur (2001) point out, "Careers nowadays are not so much planned, as improvised through the application of accumulated career capital to new, frequently unanticipated, opportunities" (p. 59). While some benefits are "bounded" within a specific timeframe or

function associated with a particular work setting (e.g., compensation, job satisfaction), others are "boundaryless" and persist after a person has left a particular job (e.g., new skills and expertise, professional networks and contacts). Similarly, employers can benefit from the residual effects of an employee's influence on a firm's policies, procedures, and attitudes even after they move on to a new opportunity.

Yet, varying degrees of physical and psychological mobility among individual actors influence the enactment of boundaryless careers and the accumulation of career capital (Sullivan & Arthur, 2006). Physical mobility is associated with transitions across boundaries (e.g., changing employers) while psychological mobility deals with perceptions of transferability of skills and the capacity to make a transition (e.g., highly specialized skills, structural barriers). Further, as previously discussed, not all workers enjoy the benefits of boundaryless careers in the same way, especially economically disadvantaged workers and those in more insecure, low-skilled jobs that do not typically provide opportunities for the accumulation of transferrable skills and professional networks. While acknowledging this dynamic, Arthur et al. (1999) argue that the boundaryless career concept does offer space for new solutions and ways of thinking about careers,

where people stay in companies not because of length of service but because of the market value of their skills; where new job aspirants are not discouraged by layers of privilege negotiated by job incumbents; where status and rank do not automatically disqualify people from applying their skills; where learning becomes a central rather than a peripheral condition behind employment arrangements... (p. 12).

Not all new college graduates will encounter such dynamic professional settings and many will not have the necessary demonstrable experience and expertise to leverage in negotiating their

first work arrangements after graduation. Yet, it is important that students preparing to enter or advance in the labor market recognize the changing dynamics of professional careers and find ways to develop their own portfolio of relevant skills, experiences, and networks to help facilitate their advancement.

Career capital and higher education. The concept of career capital, as advanced by Arthur et. al. (1999), has been applied to the field of higher education. Two studies utilizing the same data consider the relationship between career capital and community college students' career transitions. D'Amico, Rios-Aguilar, Salas, and Gonzalez Canche (2012) used the concept of career capital to develop a College and Career Capital Survey (CCCS). They argue that this concept is useful in understanding community college students' educational choices in acquiring relevant skills for the workforce. The notion of knowing-why aligns with students' aspirations to pursue higher education, while knowing-how involves their choice to attend college to gain new skills and experiences, and knowing-whom incorporates the social and information networks they gain access to in college.

From the survey (n=84), D'Amico et. al. (2012) used factor analysis to create a College-Career Alignment Index (CCAI) to measure the alignment between students' current and desired work experiences, their academic major and desired field, their work-based learning opportunities, and their expectations of local workforce demands. Results indicated that, although students had relatively low levels of college-career alignment, there was a positive relationship between career capital competencies of knowing-why, knowing-how, and knowing-whom, as well as between education and career aspirations. Further, those who relied on college networks more heavily than family networks for information about career advancement had higher levels of career alignment and knowledge of workforce demands. D'Amico et al. (2012)

argue that community colleges should help students advance their career capital competencies by encouraging students to pursue career-relevant work experiences and to gather college and career information from campus sources.

In a follow-up study using the same data, Gonzalez Canche, D'Amico, Rios-Aguilar and Salas (2014) explored the associations between informational networks and academic and career success among community college students. This study focused particularly on the knowing-whom competencies and examined students' sources of information about college and careers. Results indicated that college instructors and counselors were an important source of information about career choices for community college students, while employers were not generally utilized to gather information. Gonzalez et al. (2014) encouraged college counselors to make meaningful connections between college and career counseling, instead of just pointing students in the direction of online information and resources. Further, they argue that scholars need to gain a deeper understanding of the ways that students leverage social networks for career advancement including the role of faculty, family, and employers in supporting decision-making.

In an effort to identify predictors of success in a professional environment of boundaryless careers, Eby, Butts and Lockwood (2003) conducted a study of 458 alumni from a large public university in the Southeast. The authors identified three characteristics of boundaryless careers: perceived career success, perceived internal marketability, and perceived external marketability. Eby et al. then developed three variables as predictors of success for *knowing why* competencies, including proactive personality (i.e., identify opportunities, demonstrate initiative, etc.), openness to new experiences, and career insight (i.e., realistic career expectations, knowledge of strengths and weaknesses, etc.), and all three were significantly related to perceived career success, and marketability both inside and outside of an organization.

With regard to *knowing whom*, or personal networks, Eby et al. examined the predictive power of experience with mentors, internal networks and external networks. Internal and external networks were significantly associated with all three criteria of boundaryless careers, while mentoring relationships were only predictive of external marketability. Finally, the authors tested the relationship between career/job-related skills and career identity, the *knowing how* variables, to perceived career success, and perceived internal and external marketability. They found that both *knowing how* variables were predictive of boundaryless career success. Eby et al. also found that the *knowing why* variables had the most predictive power to perceived career success. In other words, individuals who have realistic career expectations, understand their own strengths and weaknesses, have specific career goals, are open to new professional experiences, and have a proactive personality may have the highest levels of perceived success in a boundaryless career environment.

While these studies of boundaryless careers do not deal directly with digital literacy and the role of technology in career advancement, the theory is based on a recognition of the influence of technology on organizational structures and professional career trajectories. The participants in the current study will earn a degree from a highly selective research university and one can assume that they will therefore be well-positioned among their peers to enter the professional workforce. The concept of career capital is therefore instructive in considering specific college experiences and how they might help to prepare students for the transition to professional careers. In addition, this study will explore students' perceptions of career transitions and where they gather information about career planning and the demands of their specific career field.

Taken together, Sims's (2014) concept of differentiating practices and the theories of boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999) provide a strong foundation for considering the ways that students acquire and cultivate their digital literacy skills for academic and professional purposes. The communities of practice (Lave & Wenger, 1991) that students participate in before and during college will influence their confidence and position with regard to accumulating a range of skills and competencies for professional work and career opportunities. One can assume that students who have enjoyed unfettered access to ICT training and support, are heavily involved in professional organizations, complete numerous internships, and tailor their academic choices to match their career goals will likely have a better understanding of the technical demands of their chosen career and a greater sense of control with regard to their impending transition from college to work.

Part II. Research Design and Methods

As the literature suggests, digital literacy is a newer and constantly evolving area of research. In addition, researchers are still learning about the everyday new literacy practices of college students (Wilber, 2008), and how these practices influence students' college experience and transition to the professional labor market. Therefore, this study seeks to examine the relationship between students' college experiences and acquisition of digital literacy skills in preparation for professional career transitions by using an explanatory sequential mixed method design with both quantitative and qualitative methods of data collection (Creswell, 2014). To facilitate this type of investigation, a mixed methods approach was both appropriate and advantageous.

Data was collected and analyzed in two distinct phases, with a particular focus on the experiences of low-income students, as measured by receipt of a federal Pell Grant. First, I used descriptive and comparative analysis and structural equation modeling (SEM) to explore the relationship between various factors that predict professional career planning, using survey data collected from graduating seniors at a single institution. The second phase of the study included individual interviews with students at the same institution who were preparing to graduate during that current academic year. As the explanatory sequential mixed method design dictates, the second phase of data collection was informed by survey data analysis from the first phase, and built upon these findings to gain a deeper and more comprehensive understanding of issues related to digital literacy and career preparation among graduating college students.

Four broad research questions guide this study:

1. In what ways do personal background characteristics and early access to technology influence the development of high levels of digital literacy among college students?
2. What experiences and interactions during college influence the development of digital literacy among students?
3. In what ways does digital literacy influence college students' academic choices and professional career planning?
4. What are the main sources of information that students use to gather information about the technology demands of specific professional careers?

Digital literacy is a complex and multifaceted concept and it was therefore highly beneficial to use multiple approaches to data collection and analysis to consider this area of research.

Methodological triangulation allows the researcher to use both qualitative and quantitative methods and data to examine the same phenomenon within a single study or in different

complementary studies (Tashakkori & Teddlie, 2008). Further, an explanatory sequential mixed methods design involves a two-phase project where quantitative results inform the planning and execution of the second, qualitative phase of the study (Creswell, 2014). Analysis of results therefore involves multiple stages, including examining results of each phase separately, and then considering how the two separate components inform each other and address the guiding research questions.

In the following sections, I introduce the study site and provide an overview of the first phase of the study, namely quantitative and qualitative analysis of senior survey data, including data sources, analytical approaches, hypotheses and rationales, and limitations. After that, I present the second phase of the study -- the qualitative interviews and analysis -- and describe the recruitment of participants, protocols and data collection, transcription, coding, and analysis.

Research Site

This study focused on students at a selective public research university on the west coast of the United States, hereafter referred to as Western University (WU). As a research university in a large metropolitan area that confers thousands of bachelor's degrees each year, WU prepares its graduates for the local, national, and international professional labor market. WU is a major contributor to the local and state economy, reporting billions of dollars in economic impact, tax revenue, and employment opportunities for local residents. The campus attracts hundreds of millions of dollars in research grants from government and private industry sources. It also serves a diverse undergraduate student population of whom nearly 40% receive federal Pell Grants and nearly 30% are from marginalized and underserved groups including African American, Latino/a, Chicano/a, Pacific Islander, and Native American students.

WU is a fitting location to consider issues of digital literacy. The vast majority of undergraduates are in-state residents, meaning they have attended a diverse range of public schools throughout the state. As previous research suggests, the use of technology in public schools is highly variable and correlated with socioeconomic status (e.g., Darling-Hammond et al., 2014; Margolis, 2010; Warschauer & Matuchniak, 2010). At the same time, students at this institution have gained admission to a highly competitive university and one can therefore assume that they have performed well in school and on standardized tests used in college admissions decisions. While many have likely faced adversity in various forms during their childhoods, their admission to and subsequent graduation from WU indicates that they are well positioned for professional success.

Throughout the last decade, WU has also established numerous initiatives focused on encouraging digital citizenship among students, faculty and staff, advancing information technology infrastructure and services on campus, and utilizing technology to enhance teaching and learning. A digital strategy statement created by the university's information technology office in 2011 outlined a goal of encouraging digital citizenship and preparation for a 21st century workforce. Recognizing that many students possess basic technology skills, the statement argues that students need help in acquiring marketable technology literacy as well as a strong understanding of ethics and security. In response, the institution is focused on providing online resources and training for a wide range of programs and applications along with seminar courses focused on digital citizenship to give students technology skills for the job market. The availability and utilization of these resources was discussed with study participants.

Phase I: Senior Survey

The first phase of the study involved analysis of WU's annual senior survey. Each year, all students who are eligible for graduation are invited to participate in an online survey designed to gather information about students' experiences throughout their college career, including academic courses and departments, instruction and curriculum, campus activities and engagement, technology usage, and post-graduate plans. The mixed-modal instrument includes scaled questions where students report on satisfaction with services and programs, frequency of use for a range of resources on campus, and perceptions of diverse experiences on campus, as well as open-ended questions where students can elaborate on topics ranging from meaningful learning experiences to willingness to participate in online courses to curriculum in their academic department.

This survey generally garners a high response rate with more than 5,000 graduating seniors completing the instrument each year, providing the university with information about student satisfaction and long-range trends. Senior survey responses were collected between February and June 2015, with incentive drawings at various time points to encourage participation. Approximately 5,375 students participated in the 2015 survey, representing more than 70% of the graduating class. Institutional data, such as demographics, enrollment information, and academic majors, were then merged with survey responses to facilitate descriptive and comparative analysis.

Of particular interest for this study were three key questions related to digital literacy and career transitions included in the 2015 survey (Appendix B). The first question asked students to rate their abilities in comparison to their peers on a range of traits related to digital competencies. The second question prompted students to think back on their college experience, as it related to

technology and career preparation, and consider their own level of digital competencies and skills gained through various experiences during college. The third question was an open-response format and asked students to reflect on the ways that their college experiences have prepared them for the technology demands of their future career.

Descriptive and comparative analysis. Survey data was analyzed using both quantitative and qualitative methods. First, descriptive statistics were used to examine students' responses related to the development of academic skills, professional career preparation (such as internships and undergraduate research), self-ratings of digital literacy and technology expertise, and post-graduate plans. Comparative analyses were used to look for any significant differences among groups of students based on various background characteristics, including gender, socioeconomic status, and race/ethnicity, as well as academic division and professional skills development.

In addition to the scaled questions regarding students' development of digital competencies, students had the opportunity to respond to an open-ended question: How have your experiences at [WU] helped to prepare you for the technology demands of your future profession? (i.e., online marketing, presentation skills, computational skills). Students' responses (N=2229) were coded using QSR NVivo qualitative data analysis software. I used both deductive and inductive approaches to analyze the open-ended survey responses (Creswell, 2013; Maxwell, 2012). Based on the relevant literature and theoretical framework, I developed initial organizational categories to guide the analysis of open-ended responses. Utilizing these broad themes as a starting point, I continued with a more inductive approach by categorizing the data and expanding the codebook to include emergent themes and sub-themes. A second round of analysis was completed to ensure consistency in codes across all responses. I then utilized the

qualitative analysis software to look for patterns and relationships across themes, including clustering the data by gender, race and ethnicity, and income.

Structural equation modeling. In addition to descriptive and comparative analysis of survey data, a model was proposed a priori to examine the relationships between variables that predict the development of digital competencies and confidence in career preparation among college students. The model was informed by a review of the relevant literature and was designed to answer the guiding research questions using data collected from WU's senior survey instrument. This section provides a brief overview of the analytic approach and its appropriateness for the study, as well as a description of the model and accompanying hypotheses and rationales.

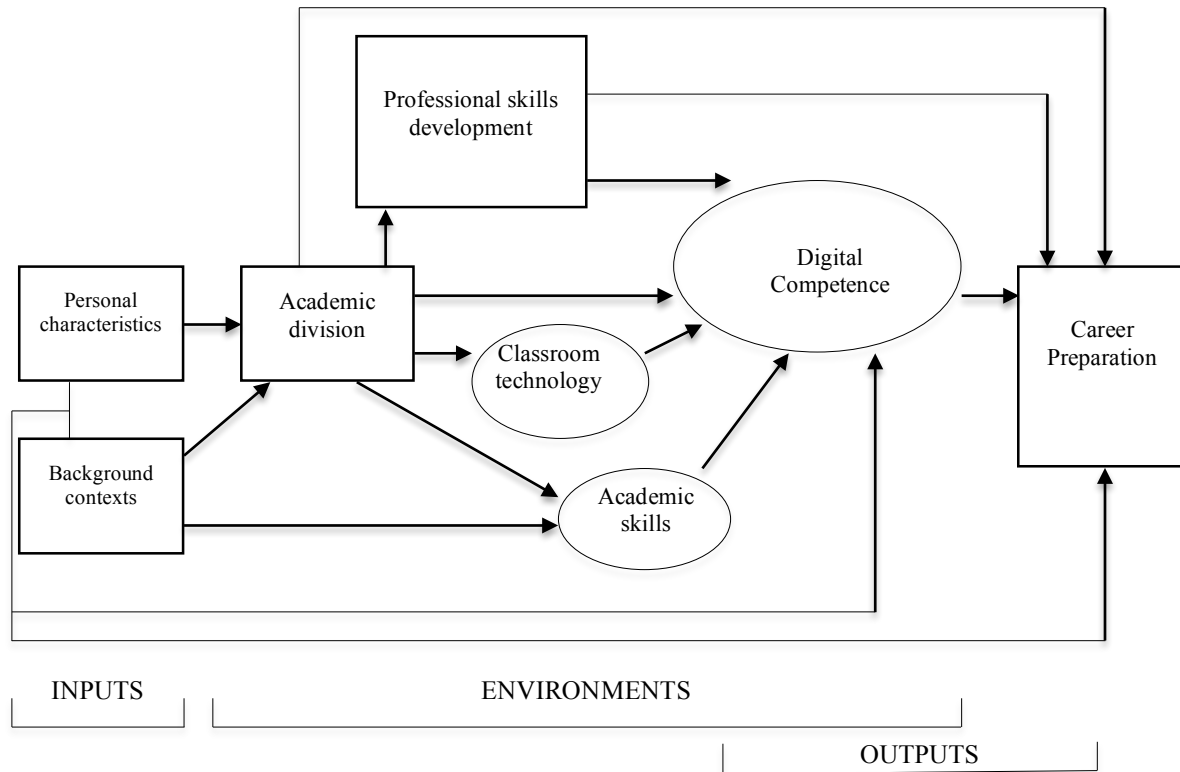
Structural equation modeling (SEM) was utilized to determine the extent to which the hypothesized relationship among variables provides an acceptable fit for the model. SEM is used to estimate the relationship among exogenous and endogenous variables in the model and confirm latent constructs (Bollen, 1989; Lei & Wu, 2007). In SEM, variables can be both exogenous, independent source variables that help to predict outcomes of interest, and endogenous, dependent result variables that can be both predicted by other variables in the model and predictors of outcomes.

There were numerous advantages to using SEM for this study. Structural equations “encompass and extend regression, econometric, and factor analysis procedures” by employing less restrictive assumptions that allow for measurement error in explanatory and dependent variables, analysis of direct and indirect effects between factors, and inclusion of multiple indicators and latent constructs (Bollen, 1989, p. xv). SEM is appropriate for use with cross-sectional data, and facilitates analysis of mediating variables. In this study, the model therefore

allowed for a deeper understanding of the relationship between numerous background contexts, personal characteristics, and college experiences in predicting the development of digital competencies. Further, it allowed for the inclusion of variables that were highly correlated but may each predict digital competencies and professional preparation. SEM is appropriate for studying the relationship between observed and latent variables, and provides overall goodness of fit indices to determine the strength and appropriateness of the model.

Conceptual model for digital competencies and career confidence. Based on a review of the literature, a conceptual model was proposed a priori to examine the relationship between variables that predict high levels of digital competencies and confidence in preparation for the job market and technology-related career skills (Figure 2). The proposed model was developed for this study to address the research questions and to utilize the existing data available in the WU senior survey. While it was not adapted from any existing models, the proposed model was informed by elements of the Social Cognitive Career Theory (SCCT) Model of Career-Related Choice Behavior (Lent et al., 1994) and subsequent adaptations of the model that focused on technology related fields (Lent, Lopez Jr., Lopez & Sheu, 2008; Smith, 2002).

Figure 2. Conceptual Model of Digital Competencies and Career Confidence



SCCT served as an organizational framework for the conceptual model in this study, and was used to help guide the organization of variables. The model follows the same general framework with personal inputs and background contexts influencing learning experiences in college. These learning experiences and other contextual factors in turn influence outcome expectations. The theoretical frameworks guiding this study, including the concepts of differentiating practices and career capital, served as the interpretive frameworks for the proposed model. Through involvement in communities of practice and legitimate peripheral participation, students gain a particular set of skills and attitudes toward technology for academic, personal, and professional purposes. The model examined the relationship between

academic and pre-professional experiences in college, and the development of digital competencies. Further, the model considered how students' experiences in internships and undergraduate research, which help develop career capital through knowing how and knowing whom competencies, coupled with various academic experiences, which support students' development of strong career goals or knowing why competencies, influence their confidence related to career transitions.

The conceptual model built on the previous research to examine the relationship between student background and characteristics, various college experiences, and the development of digital competencies and career confidence. The model focused primarily on two outcomes of interest: digital competencies and post-graduate preparation. I used exploratory factor analysis to create a latent construct for *Digital Competencies* from the set of indicator variables related to digital competencies. As Table 1 indicates, the construct represents students' self-reported skills and attitudes related to ICT, including measures of students' ability to critically evaluate online information and effectively communicate in online and technology-assisted formats, and a belief that technology expertise is an essential tool for the professional workforce (Table 1).

Table 1

Latent Construct for Self-Rated Digital Competence, alpha = .879

Variable	Factor loadings	Mean	SD
Ability to engage in social media for professional purposes	.811	3.55	0.91
Effective communication skills in online spaces and forums	.800	3.68	0.89
Ability to engage in social media for personal communication	.845	3.64	0.84
Ability to critically evaluate online sources	.634	3.71	0.80
Ability to navigate the internet for academic research purposes	.608	3.94	0.76

¹ Scale: Rate yourself on each of the following traits as compared with the average person your age: 1= lowest 10%, 2=below average, 3=average, 4=above average, 5=highest 10%

The second outcome measure, *Career Confidence*, includes two variables representing students' confidence in relation to technology-proficiency for their chosen career, and the extent to which their undergraduate experience has prepared them for the job market (Table 2).

Table 2

Variables and Coding for Career Confidence

Variable	N	Mean	SD	Coding
How well do you think your undergraduate experience at [WU] has prepared you for the job market?	5101	3.10	0.79	1 = very inadequately, 2 = inadequately, 3 = generally well, 4 = very well
I am confident that I have the necessary skills and expertise for the technology demands of my future profession.	4887	3.23	0.70	1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

The proposed model incorporated three exogenous variables for *Personal Characteristics* and *Background Contexts*, including gender, status as an underrepresented minority student (self-identified as Black/African American, Latino/a, Chicano/a, Pacific Islander, and Native American), and status as a federal Pell Grant recipient, based on family income (Table 3). Each of these variables has been shown to influence academic performance and persistence in college (e.g., Engle & Theokas, 2010; Horn, Berger & Carroll, 2004; Ishitani, 2006; Melguizo, 2008; Taniguchi & Kaufman, 2005; Thayer, 2000; Titus, 2006). Further, as previously discussed, sex, gender roles, race/ethnicity, and family income can be predictive of computer self-efficacy and confidence with ICT (Huffman et al., 2013; Margolis, 2010).

Table 3

Variables and Coding for Personal Characteristics and Background Contexts (N=5375)

Variable	Percentage	Coding
<u>Personal Characteristics</u>		
Gender: Female	62.3	1=Male, 2=Female
Underrepresented minority student	26.9	1=Non-URM, 2=URM: Black/African American, Latino/a, Chicano/a, Native American, and Pacific Islander
<u>Background Contexts</u>		
Pell grant recipient	40.4	1=Not eligible/did not receive, 2=Pell grant recipient

Academic Division (i.e., humanities, social sciences, life sciences, etc.) was included in the model as an endogenous variable to consider differences in technology usage in classrooms across fields, as well as variability in attitudes about the relevance of digital competencies for academic and professional purposes (Table 4). A significant body of research has documented new strategies for incorporating technology-supported active learning pedagogies into classrooms across academic disciplines (e.g., Eagan et al., 2013; Salmon, 2005), but differences still exist in the way these strategies are deployed by instructors across courses, disciplines, and institutions. Personal background characteristics may also predict students' choice of academic discipline. Research indicates that women and historically underserved student populations, including African Americans, Latino/as, and Native Americans, are underrepresented in many STEM fields (National Science Foundation, 2015), and that student who attend lower-resourced and racially segregated schools may have limited opportunities to complete the necessary coursework and preparation for some STEM fields (Margolis, 2010; Chang, Sharkness, Hurtado & Newman, 2014; Russell & Atwater, 2005). *Academic division* can also influence *professional*

skills development, experiences with *classroom technology*, and the development of *academic skills*.

Table 4

*Academic Division (N=5375)**

	N
Humanities	784
Social Sciences	2369
Life Sciences	1477
Physical Sciences	767
All Others (Arts & Architecture, Theater, Film & TV, International Inst., Other)	338

* *Includes double majors*

The next group of endogenous variables in the model includes student learning experiences relevant to the development of digital literacy and career preparation: professional skills development, academic skills, and classroom technology. *Professional Skills Development* is measured by self-reported participation in internships and undergraduate research during college (Table 5). The variable for participation in undergraduate research was created as a combination of three items where survey respondents indicated whether or not they assisted faculty with research for pay or as a volunteer. Students' professional skills development is often correlated with their academic discipline, as it will predict their level of participation in these activities and the types of internship or research activities in which they are engaged in college. As previously stated, employers also view internships and research experiences as important components of career preparation and consider these experiences in hiring new employees (Hart Research Associates, 2010). Further, undergraduate research experiences positively influence academic engagement, learning, and persistence (Craney, Mckay, Mazzeo, Morris, Prigodich & de Groot, 2011; Eagan et al., 2013; Villarejo et al., 2008).

Table 5

Variables and Coding for Self-Reported Participation in Professional Skills Development Activities (N=5375)

	Percentage	Coding
Completion of one or more internships	48.3	How many internships did you have while you were enrolled at [WU]? Scale: 1=Zero, 2=1, 3=2, 4=3, 5=4, 6=5 or more
Assisted [WU] faculty in research for pay.	9.5	Scale: 1=Yes, 2=No, did not choose to, 3=No, not available
Assisted [WU] faculty in research as a volunteer	31.1	Scale: 1=Yes, 2=No, did not choose to, 3=No, not available
Assisted faculty at another university with research for pay or as a volunteer	5.8	Scale: 1=Yes, 2=No, did not choose to, 3=No, not available
Participation in undergraduate research (combination, unduplicated)	35.0	Scale: 1=Yes, 2=No

Academic Skills is a latent construct representing students' perceptions of their skills and competencies gained during college, and includes measures such as openness to new ideas and experiences, critical thinking skills, the ability to make informed decisions, and the ability to uphold high ethical standards (Table 6). The construct accounts for 71.88% of the variance in responses, with a Cronbach's alpha of 0.908. As an endogenous variable, *Academic Skills* is predicted in the model by both *Background Contexts* and *Academic Division*. Students' development of academic skills is often influenced by their experiences in coursework for their academic major. In addition, schooling can influence the academic skills that students accrue before college, and, as the literature suggests, students from low-income backgrounds often attend schools that offer less coursework and guidance to prepare them for college. *Academic Skills* also predict *Digital Competence* in the model. Based on Martin's (2008) definition, digital

literacy includes a range of analytical, critical thinking, creative, and communication skills that are closely aligned with the academic skills measured by the latent variable construct.

Table 6
Latent Construct for Academic Skills Gained During College, alpha = .908

Variable	Factor loading	Mean	SD
Critical thinking	.874	3.31	0.74
Ability to make informed decisions that require analyzing information from many perspectives	.845	3.26	0.743
Confidence in approaching new areas of learning	.815	3.23	0.798
Openness to new ideas and experiences	.797	3.35	0.767
Ability to communicate effectively in writing	.735	3.15	0.817
Quantitative reasoning	.734	3.13	0.803

Scale: Please indicate to what extent your [WU] experience has contributed to you: 1 = none/very little, 2 = some, 3 = quite a bit, 4 = very much

Finally, *Classroom Technology* is a latent variable representing students' perceptions of classroom technology usage on campus (Table 7). The construct accounts for 59.57% of the variance in responses, with a Cronbach's alpha of .869. It is an endogenous variable in the model predicted by *Academic Division* and a predictor of *Digital Competence*. As previously stated, instructors across academic disciplines use technology in different ways and therefore students with majors in different divisions, such as life science or humanities, may have varying attitudes toward classroom technology usage. These varying experiences with technology may also

influence the types of skills that students develop and their confidence with regard to digital literacy skills and competencies.

Table 7

Latent Construct for Perceived Useful of Classroom Technologies, alpha=.869

Variable	Factor loading	Mean	SD
Blogging tools (e.g., to keep a class-related journal)	.905	2.37	1.48
Online self-tests (e.g., to give you feedback on your knowledge of class material)	.787	2.97	1.50
Chat tools (e.g., to brainstorm with several other students at once)	.787	2.79	1.52
Visualization tools, simulations, or animations (e.g., to help you learn difficult concepts)	.690	3.31	1.49
Web-based threaded discussion tools (e.g., to discuss class material with other students)	.580	3.43	1.29

Scale: How useful have each of the following educational technologies been to you in your coursework: 1=Never used, 2=Not at all useful, 3=Slightly useful, 4=Moderately useful, 5=Very useful

Hypotheses and rationale. The study model was designed to explore the ways that various background characteristics and contexts along with specific experiences in college may influence the development of digital literacy skills and professional career preparation. Specifically, the model tested the following hypotheses designed to address the guiding research questions:

Research question 1. In what ways do early access to technology and personal background characteristics influence the development of high levels of digital literacy among college students?

Hypothesis and rationale 1. I hypothesized that personal background characteristics and contexts would directly and indirectly influence the development of digital competencies. Research indicates that personal characteristics and background contexts such as family income, parental education, and race and ethnicity have been strong predictors of computer and internet access (Norris, 2001; USCD, 2013). In addition, these factors often predict school context, which in turn influences students' early experiences with computers and ICT (Margolis, 2010; Warschauer, 2003, 2008).

Research question 2. What experiences and interactions during college influence the development of digital literacy among students?

Hypothesis and rationale 2a. I hypothesized that students' professional skills development, including participation in an internship or undergraduate research experience, would influence the development of digital competencies and preparation for the technology demands of work. Advances in computers and ICT have placed new demands on workers, including higher order cognitive and problem-solving skills (Autor, Levy & Murnane, 2003; Levy & Murnane, 2004; Brynjolfsson and McAfee; 2014). While universities are focused on helping students to gain a broad range of 21st century skills, the curriculum does not always focus on career-specific competencies. Therefore, internships and hands-on guided research experiences provide students with applied learning experiences relevant to specific academic and professional contexts (Callanan & Benzing, 2004; Mourshed, Farrell & Barton, 2012).

Hypothesis and rationale 2b. I hypothesized that students' academic division and academic skills development would influence the development of digital competencies and preparation for the technology demands of work, directly and through their academic skills development and experiences with classroom technology. Technology-supported active learning

pedagogies have become an area of particular interest for institutions of higher education eager to utilize technology to engage students and improve learning outcome (Groves & Zemel, 2000; Salmon, 2005). At the same time, there are significant differences in the ways that technology is utilized by instructors across courses, disciplines, and institutions based on a range of perceived and real barriers to implementation (Ebert-May, Derting, Hodder, Momsen, Long & Jardeleza, 2011; Groves & Zemel, 2000; Spotts, 1999). I used life sciences as the reference group to examine students' attitudes toward classroom technologies and its influence on digital literacy.

In addition, ICT usage and field-specific technologies vary greatly across academic disciplines. Students' attitudes toward classroom technologies may therefore be influenced by their specific experiences with courses and instructors, and the ways that technology is used to support academic learning. In this way, students' choice of major may indirectly affect digital literacy through differences in exposure to classroom technology and the development of confidence in one's digital literacy skills related to academic and professional domains. The communities of practice that students engage in related to their academic interests may also impact the range of skills and competencies they gain in college as well as their confidence with regard to digital literacy for academic and career purposes.

Research question 3. In what ways does digital literacy influence college students' academic choices and professional career preparation?

Hypothesis and rationale 3. I hypothesized that students' level of digital literacy would influence their confidence with regard to professional career transitions. While this hypothesis has not been directly tested in previous research, numerous studies and reports have documented the changing nature of work (e.g., Brynjolfsson & McAfee, 2014; Kalleberg, 2009) and the shifting demands of employers including the desire for employees to have a wide range of 21st

century skills and technology expertise (e.g., Hart Research Assoc., 2010; Heitner & Miller, 2010). Therefore, it seems reasonable to expect that students who are more confident in their technology skills and digital literacy would likely be more confident with regard to their transition to a professional work after graduation regardless of the career field. Specifically, students were asked to rate their confidence with regard to the technology demands of their future career, and the extent to which their college experience has prepared them for the job market.

Analyses. To prepare for SEM, I reviewed the descriptive statistics for all variables, including frequencies, means and standard deviations. This study utilized MPLUS, a structural equation modeling software, to test the proposed model of digital literacy and career confidence through measurement specification, model estimation, evaluation, and modification. The first stage of analysis included evaluating the correlations and overall fit for the three latent constructs in the proposed model. I then examine the overall model fit, including paths between all variables in the proposed model.

As previously stated, SEM is used to analyze the relationship among exogenous and endogenous variables, including observed variables and latent constructs. Therefore, SEM is designed to estimate numerous different relationship between the variables in the model, as opposed to the limitations of assessing the influence of independent variables on a single dependent variable. Parameter estimates are generated through analysis of “observed covariance matrix (data) and the model-implied covariance matrix (model)” using the maximum likelihood method, (Lei & Wu, 2007, p. 36). Once the model parameters have been estimated, the proposed model is tested to determine the overall model goodness of fit, which accounts for measurement error and tests the null hypothesis that the model fits the data. Several model fit indices were

utilized to assess the overall model fit, including the Chi-square test statistic, Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). In addition, model modification techniques were employed to ensure the best overall fit. The Lagrange multiplier test was used to consider whether the addition of a new parameter would improve model fit, while the Wald test will be used to determine if any parameters are not necessary in the model (Ullman, 2006).

Limitations. There are several limitations associated with the quantitative component of this study that should be mentioned. First, the use of cross-sectional survey data creates some limitations with regard to analysis and the interpretation of findings. Without being about to determine the order of particular events, it is difficult to assess the direction of some causal relationships. For example, in the proposed model, all data were collected near the end of the students' undergraduate program and therefore represent a snapshot of students' self-ratings of academic skills and digital literacy. The model hypothesizes that students' academic division, professional development experiences, academic skills, and experiences with classroom technology influence their digital literacy skills. Yet, high levels of digital literacy at the beginning of college may have also influenced a students' decisions with regard to choosing an academic major or participating in a particular internship or undergraduate research experience. This is also a single-institution study and is therefore not generalizable to institutions across the country.

In addition, the WU senior survey data being used in this study were not specifically designed to collect information about students' digital literacy skills. The senior survey gathers general information about students' college experiences and post-graduate plans. I am therefore limited to the variables available in the survey in trying to understand students' experiences and

attitudes toward digital literacy for academic and professional purposes. In this sense, the second part of the study where I collected qualitative data from graduating seniors was important to gaining a deeper understanding of the findings that emerge through quantitative analysis of survey responses.

Finally, digital literacy is a multifaceted and complex concept that is difficult to represent with survey responses and a single latent construct. Further, information about digital literacy was gathered using self-reported ratings of ability as opposed to demonstrable measures of skills and competencies. Therefore, this study focuses on learning more about students' perceptions of specific skills associated with digital literacy and the contributions of particular experiences their self-assessment.

Phase II: Interviews with Graduating Seniors

The second phase of data collection focused on gaining a deeper understanding of individual students' experiences and attitudes related to information and communication technologies, and how these may have influenced their professional career preparation. I conducted qualitative interviews with a purposeful sampling of seniors at the same institution who were on track to graduate during spring and summer of 2016. Qualitative research interviews are an attempt "to understand the world from the subjects' points of view, to unfold the meaning of people's experiences, to uncover their lived world prior to scientific explanation," (Kvale, 1996, p. 1). While the first phase of this study highlighted the relationship between certain factors that influence digital literacy and career confidence, learning about the experiences of individual students was meant to illuminate these relationships and provide an opportunity for a more in-depth examination of these complex issues.

Recruitment and sample composition. Utilizing institutional data sources, a recruitment email was sent from the Registrar to a random sample of 350 WU students with senior standing inviting them to participate in the research study. Survey recipients were selected to reflect the diverse campus population according to gender, race/ethnicity, and academic discipline. In line with the study objectives, students' economic background was another important consideration in recruitment and selection of participants. As such, half of the recruitment emails (n=175) were sent to students eligible for need-based federal financial aid, including federal Pell Grants.

The recruitment email also included an information sheet outlining the purpose of the study, the requirements of participation, benefits and risks, and participant's rights. Interested students were asked to link directly to the online survey from the recruitment email, which was administered using SurveyMonkey to ensure student privacy. Fifty-two students responded to the survey, a response rate of 15%. At the end of the survey, students were invited to participate in a follow-up interview, and provide their name and email to receive further information and to schedule their interview. All student who complete the online questionnaire were included in a drawing for one of two \$50 gift card. Winners were selected at random and received their e-gift card via email.

Data collection. The screening questionnaire was designed to determine whether or not each respondent was an appropriate match for the study, gather information about students' digital literacy skills, and provide background information for the personal interviews. Students were asked to provide information about their post-graduate plans, everyday digital literacy practices as outlined by Martin's (2008) framework, and select demographic information (Appendix C). All students who had plans to graduate during Spring/Summer 2016 and were interested in participating in a follow-up interview were contacted via email. About half of the

survey respondents, 27 students, indicated that they would be willing to participate in an interview and were planning to graduate. Ideally, I would have invited more students to complete the screening questionnaire to ensure broad representation across income levels, academic disciplines, and levels of digital competencies, but I was unable to send it out to a larger sample of students and therefore contacted as many students as possible from the original pool of recipients to participate in a follow-up interview.

I conducted qualitative interviews with 16 students during May and June of 2016. Interviews were conducted over the phone or via videoconferencing based on the students' preference, were recorded with permission, and transcribed verbatim. Our conversations focused on four main topics: early experiences with ICT at home and school, digital literacy practices in college, professional development experiences such as work, internships and research, and preparation for their professional career transition after graduation (Appendix D). Through these topics, I tried to learn about students' perceptions of digital literacy, the usefulness of ICT skills for academic and professional purposes, and their confidence with regard to digital literacy for academic and professional purposes. Interviews ranged from around an hour to an hour and half, and all students indicated that they would be willing to speak with me again in a year to follow up on their transition to the workforce. All participants received a \$10 gift card at the completion of their interview.

Profile of interview participants. As stated, the screening questionnaire was designed to gather information about students' confidence related to their digital competencies, their everyday computing and ICT practices, and their personal background characteristics. The questionnaire included 18 statements designed to measure the 13 components of digital competence outlined by Martin's (2008) framework: statement, identification, accession,

evaluation, interpretation, organization, integration, analysis, synthesis, creation, communication, dissemination, and reflection (see Appendix A). Students were asked to rate their level of skill and knowledge in each area relative to their peers on campus, with a nine-point scale that provided a text description for only the lowest and highest points: 1= “minimal skills and knowledge” and 9 = “high levels of skill and confidence.”

Among responses to the screening questionnaire, students were most confident in their ability to locate and obtain digital academic resources ($M=7.51$, $SD=1.39$), to communicate and collaborate with friends and peers using online and social media platforms ($M=7.33$, $SD=1.86$), and to critically evaluate the reliability of information and sources online ($M=7.24$, $SD=1.33$). They were least confident in their ability to utilize field-specific software and applications to complete projects and tasks ($M=5.67$, $SD=2.47$), and to remix and reuse digital resources and information, or apply them, to achieve academic ($M=5.69$, $SD=2.04$) and professional tasks ($M=5.79$, $SD=2.08$). The average self-rating across the 18 measures of digital competence included in the questionnaire was 6.68 for all respondents, with responses ranging from 2.78 to 9.00.

The 16 students who completed an individual interview had composite mean score for digital competence (based on the 18 scales in the screening questionnaire) that ranged from 4.17 to 9.00, with an average of 6.88 ($SD=1.54$; see Table 8). Seven students had mean scores below the average of 6.67 for the full group, and nine students were above. Twelve of the 16 students (75%) were female, and six (38%) were first-generation college students. More than half of the students (63%) graduated with an academic major in either the Humanities or Social Sciences, and nine (56%) reported a family income of less than \$75,000/year.

Table 8

Characteristics of Interview Participants

	Digital competence ¹	Academic division	Gender ²	Need-based aid ³	Family income ⁴	First generation ⁵
1	4.17	Humanities	F	Y	Low	Yes
2	4.60	Humanities	F	Y	Low	No
3	4.61	Social Science	F	N	High	No
4	5.56	Humanities	F	Y	Low	Yes
5	6.11	Social Science	F	N	High	No
6	6.22	Humanities	F	Y	Low	Yes
7	6.39	Life Science	M	Y	Low	Yes
8	7.33	Life Science	F	Y	Low	No
9	7.44	Humanities	F	Y	Low	Yes
10	7.67	Life Science	F	Y	High	No
11	7.78	Life Science	F	N	High	No
12	8.00	Physical Science	M	Y	Low	No
13	8.11	Humanities	M	Y	High	Yes
14	8.50	Social Science	F	N	High	No
15	8.61	Life Science	F	Y	High	No
16	9.00	Humanities	M	Y	Low	No

¹ Average score across 18 measures of digital competence included in screening questionnaire

² F = female; M = male

³ Self-reported eligibility for need-based financial aid

⁴ Self-reported family income; based on income ranges included in questionnaire, low = less than \$75,000/year, high = more than \$75,000/year

⁵ Self-reported status as first in immediate family to graduate from college (includes students whose siblings attended college; does not specify 2- or 4-year degree)

⁶ Based on average across 18 measures of digital competence for full sample of questionnaire respondents (N=47)

Data analysis. Analysis of the qualitative interviews was an iterative process that started during the data collection phase, with initial review of early interviews informing subsequent interviews (Maxwell, 2013; Patton, 2002). Once all of the interviews were completed, I organized and coded the data in several phases using QRS NVivo qualitative data analysis software. I used what Maxwell (2013) describes as organizational, substantive, and theoretical categories to guide my analysis. Organizational categories are broad issues that require further

analysis, and are often established prior to data collection. I build a preliminary coding structure based on the broad topics covered in the interviews: early experiences with computers and ICT, use of computers and ICT in college, professional development experiences, and post-graduate plans. I then reviewed all of the interviews and allowed sub-themes within this initial framework and additional themes to emerge.

During this first round of coding, I also looked for substantive categories, including descriptions of participants' beliefs and perceptions. This allowed me to gain a better understanding of areas of similarity and contiguity among participants (Maxwell & Miller, 2008). These substantive categories often focus on the participants' own words and concepts, but can also be informed by the researcher's understanding of particular topics and situations. I therefore used both the participants' own understanding of particular phenomena and broader analysis of the collective interview data to consider contiguous relationships among participants. For example, students' perceptions of competence and usage of digital technologies was relative to their own experience. It was important for my analysis that students' own words to drive my interpretation of these themes as well as my understanding of college students' everyday use of information and communication technologies.

My analysis of interview data was also informed by the theoretical frameworks guiding this study. After going through the interviews and looking for emergent themes, I went back and analyzed the transcripts again using theoretical categories based on situated learning theory, the concept of differentiating practices, and the theory of boundaryless careers and career capital. Examining the data from this perspective allowed me to look for patterns and themes across the data that inform theoretical concepts such as the career capital constructs of knowing why, knowing how, and knowing whom, or the ways that particular communities of practice influence

participants' usage of ICT and self-ratings of ability per the concepts of situated learning and differentiating practices.

Throughout the process, I focused on emergent themes and sub-themes that would warrant deeper consideration. Considering the multiple levels of the data analysis, the qualitative data software helped to facilitate the creation of matrices and separate groupings of data according to variables of interest such as family income, level of digital literacy, gender, and pre-professional experiences such as research and internships. Above all other considerations, I tried to focus on letting the student voices guide my analysis and formulate the categories and themes that collectively constitute the major findings of the study.

Limitations. There are several limitations associated with the qualitative component of the study that may impact the findings. First, the interviews were conducted with students at a single institution and are not be generalizable beyond that particular campus. Second, the analysis of students' level of digital literacy was based solely on self-reported data on students' new literacy practices, skills, and ability. Therefore, study findings do not report on tangible measures of digital competence but instead focus solely on students' perceptions of digital literacy and its utility for academic and professional purposes. While this fact limits some aspects of the research, the current study is guided by a sociocultural theoretical framework that recognizes the importance of students' interactions and contexts in creating meaning and understanding of their lived experience, and therefore focused on learning more about students' college experiences and how these helped to shape their career goals and inform their preparations for life after graduation.

Qualitative data collection was limited to one round of personal interviews with participants and represents only a moment in time on their academic and professional journey.

The study is limited to examining students' views of digital literacy and career transitions at a particular point in time, and does not measure students' acquisition of new skills and competencies, or changes in confidence or awareness throughout the course of their college career. Further, response to the screening questionnaire and invitation to participate in an interview was not as high as originally anticipated and therefore I spoke with all of the students who fit the basic criteria for the study and were interested in participating in an interview. This led to some imbalance with regard to gender and specific groupings of income level, and limits the generalizability of the findings. Finally, for this study I asked students to speculate about the ICT demands of professional work settings and the challenges of transitioning from college to career. Subsequent data collection with participants after they graduate and become established as working professionals would provide additional information about the ways that the college experiences influenced their career trajectory.

CHAPTER 4: FINDINGS FROM PHASE I

In this chapter, I present findings from Part I of the study. In Part I, I used structural equation modeling (SEM) and qualitative coding to analyze data from a 2015 survey sent to graduating seniors at WU. In this study, I was particularly interested in the experiences of lower-income students, as defined by eligibility for federal Pell Grants, and therefore the findings discussed in this chapter will focus on this specific population. In the following sections, I first provide descriptive and comparative analyses of the survey data, and then present findings for the hypotheses tested with the structural models designed a priori for this study. In the final section, I share the emergent themes from students' responses to the open-ended question about college experiences that have prepared them for the tech demands of their future profession.

Characteristics of the Study Sample

As Table 9 illustrates, responses to the 2015 Senior Survey (N=5375) represent a wide range of enrolled students similar to the overall population at WU. Approximately 62% of respondents were female, 40% were Pell Grant recipients, and 20% were first generation college students. More than 50% of respondents planned to pursue employment immediately after graduation, while more than 30% had plans to attend graduate or professional school.

Table 9

Characteristics of Survey Sample (N=5375)

	Percentage
Female	62.33
Pell grant recipient	40.35
First generation college student	20.71
Transfer student	38.01
American Indian	0.47
Asian or Pacific Islander	43.29
Black	3.48
Latino/a	19.26
White	29.64
Plans for graduate school	31.24
Plans for employment	50.87

Descriptive and Comparative Analyses

Survey respondents were asked to rate their abilities in comparison to peers on a range of digital competencies including navigating the internet, computer programming and coding, and communication skills in online spaces (Table 10). Students were most confident in their ability to navigate the internet for academic and professional purposes with 71.4% rating themselves above average compared to their peers. Nearly six in ten students rated themselves above average in their ability to critically evaluate online sources (59.9%), and their ability to engage in social media for personal communication (58.1%). Students were least confident in their skills related to computer programming, coding and website design, with just over 20% rating themselves above average in these categories.

Table 10

Proportion of Students Who Rated Themselves Above Average on Measures of Digital Competence

	N	Percentage ¹
Ability to navigate the internet for academic research purposes	5002	71.4
Ability to critically evaluate online sources	4979	59.9
Ability to engage in social media for personal communication	4957	58.1
Effective communication skills in online spaces and forums	4992	55.2
Ability to engage in social media for professional purposes	4982	51.1
Confidence with learning new programs and apps	4981	49.8
Computer programming and coding	4974	20.2
Website design	4968	20.2

Scale: 1= lowest 10%, 2=below average, 3=average, 4=above average, 5=highest 10%

¹ All students who rated themselves as "above average" or "highest 10%"

Independent samples t-tests were conducted for this group of questions to look for differences in students' self-ratings of digital competence by gender and status as a Pell Grant recipient. Male respondents were significantly more confident than women in the sample in their digital competencies across numerous categories, including their ability to navigate the internet for academic and professional purposes, computer programming and coding skills, confidence in learning new programs and apps, and ability to critically evaluate online sources (Table 11). Research indicates that individuals' self-perceptions of ability may not be highly correlated with actual ability and that women are more likely to underestimate their abilities compared to males, but the misalignment of confidence with actual abilities can have real consequences in students' academic and professional choices (Ehrlinger & Dunning, 2003).

Table 11

Results of t-test and Descriptive Statistics for Self-Ratings of Digital Competence, by Gender

	Female		Male		t	df
	M	SD	M	SD		
Ability to navigate the internet for academic research purposes	3.89	0.76	4.02	0.80	5.87*	4952
Computer programming and coding	2.40	1.05	2.77	1.17	11.01*	3476.38
Confidence with learning new programs and apps	3.42	0.86	3.67	0.90	9.69*	3650.33
Ability to critically evaluate online sources	3.64	0.78	3.84	0.81	8.58*	4942
Ability to engage in social media for personal communication	3.69	0.85	3.66	0.95	1.23	3487.46
Ability to engage in social media for professional purposes	3.54	0.87	3.56	0.96	0.77	3522.67
Effective communication skills in online spaces and forums	3.62	0.81	3.68	0.88	2.35*	3557.63
Website design	2.52	1.04	2.73	1.14	6.45*	3515.29

Scale: 1=lowest 10%, 2=below average, 3=average, 4=above average, 5=highest 10%

* $p < 0.05$

Analyses revealed that Pell Grant recipients rated themselves similarly in most categories to their higher-income peers, with the exception of computer programming and website design skills (Table 12). Pell grant recipients were significantly less confident in their computer programming and coding skills ($M=2.49$, $SD=1.11$) compared to their higher-income peers [$M=2.57$, $SD=1.12$; $t(4977) = 2.53$, $p < .05$]. Similarly, lower-income students were significantly less confident in their website design skills ($M=2.55$, $SD=1.11$) than their higher income peers [$M=2.63$, $SD=1.07$, $t(4193.60) = 2.50$, $p < .05$]. Among Pell Grant recipients, male students were similarly more confident in their abilities as compared to females, although there were no significant differences among Pell-recipient males and Pell-recipient females.

Table 12

Results of t-test and Descriptive Statistics for Self-ratings of Digital Competence, by Status as a Pell Grant Recipient

	Pell Grant Recipient		Not Eligible for Pell		t	df
	M	SD	M	SD		
Ability to navigate the internet for academic research purposes	3.93	0.77	3.94	0.78	0.55	5000
Computer programming and coding	2.49	1.11	2.57	1.12	2.53*	4977
Confidence with learning new programs and apps	3.54	0.87	3.50	0.89	1.47	4955
Ability to critically evaluate online sources	3.70	0.81	3.72	0.79	0.54	4990
Ability to engage in social media for personal communication	3.71	0.90	3.66	0.88	1.81	4980
Ability to engage in social media for professional purposes	3.58	0.92	3.53	0.90	1.86	4979
Effective communication skills in online spaces and forums	3.66	0.86	3.63	0.82	1.28	4218.01
Website design	2.55	1.11	2.63	1.07	2.50*	4193.60

Scale: 1= lowest 10%, 2=below average, 3=average, 4=above average, 5=highest 10%

* $p < 0.05$

As discussed in previous sections, disparities persist in the availability of advanced computing courses and the ways that digital technologies are incorporated into classroom instruction in schools that serve lower-income neighborhoods and communities of color (i.e., Margolis, 2010; Shank & Cotten, 2014; Warschauer, Cotten & Ames, 2011). Limited opportunities to learn computer coding and other more advanced digital skills in school may influence a students' desire to pursue computer science and other technology-focused degrees in college where they likely would gain new skills and competencies. Further, students who have

not been introduced to computing in school may not want to enroll in specific courses that require these skills as a baseline for more advanced projects. While some students gain confidence in creating videos and blogs, developing advanced research skills, and using simulations and tutorials to deepen their concept mastery, others are limited to basic internet searches and online drill and practice activities.

Students were also asked to indicate their level of agreement with a number of statements related to their computer skills and digital competencies (Table 13). The vast majority of students reported that they agreed or strongly agreed with all of the statements in this group, with mean scores ranging from 3.05 to 3.41, on a four-point scale from strongly disagree to strongly agree. More than half of the survey respondents strongly agreed that skills and expertise related to technology was an essential tool for the professional workforce (53.7%). Yet, less than four in ten students reported that they strongly agreed that they had gained these new skills and expertise through internships (36%), undergraduate research experiences (32.4%) and academic courses (31.1%) that they participated in during college.

Table 13

Proportion of Students Who Strongly Agreed with Statements Regarding Digital Skills Acquisition During their College Experience

	N	Percentage ¹
I believe that having strong skills and expertise related to technology is an essential tool when you enter the professional workforce.	4878	53.7
I am confident in my ability to critically evaluate online materials and sources.	4919	46.7
I am able to effectively communicate ideas and concepts in online and technology-assisted formats.	4889	43.6
I am confident that I have the necessary skills and expertise for the technology demands of my future profession.	4887	36.6
I have gained new skills and expertise related to technology at an internship or professional experience during college.	4108	36.0
I have gained new skills and expertise related to technology in my undergraduate research experiences.	4186	32.4
I have gained new skills and expertise related to technology in my college courses.	4869	31.1

Scale: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

¹ All survey respondents who selected “strongly agree” for each statement

Independent samples t-tests were conducted to look for differences in students’ level of agreement with this group of statements, by gender and status as a Pell Grant recipient. Male students were significantly more confident that they had the necessary skills for their future profession (M=3.30, SD=0.69) than female peers [Table 14; M=3.18, SD=0.70; $t(3761.20) = 5.67, p < .05$]. They were also more confident in their ability to critically evaluate online materials and to effectively communicate ideas in online and technology-supported formats. Further, male students reported greater gains in their technology skills and expertise from

coursework, undergraduate research, and internships compared to female peers. Pell Grant recipients reported similar levels of agreement as their non-Pell eligible peers on all measures except the impact of internships. Respondents who were not eligible for need based financial aid were significantly more likely to agree that they had gained new skills and expertise related to technology in their internships ($M=3.16$, $SD=0.80$) as compared to peers who received federal Pell Grants [Table 15; $M=3.11$, $SD=0.81$; $t(4106) = 2.11$, $p < .05$].

Table 14

Results of t-tests and Descriptive Statistics for Self-ratings of Digital Skills Acquisition, by Gender

	Female		Male		t	df
	M	SD	M	SD		
I am confident in my ability to critically evaluate online materials and sources.	3.38	0.61	3.48	0.59	5.55*	4871
I am able to effectively communicate ideas and concepts in online and technology-assisted formats.	3.35	0.60	3.42	0.61	3.98*	4841
I believe that having strong skills and expertise related to technology is an essential tool when you enter the professional workforce.	3.47	0.60	3.51	0.62	1.97*	4831
I have gained new skills and expertise related to technology in my college courses.	3.01	0.80	3.13	0.82	5.21*	3623.64
I have gained new skills and expertise related to technology in my undergraduate research experiences.	3.05	0.79	3.17	0.80	4.80*	3199.85
I have gained new skills and expertise related to technology at an internship or professional experience during college.	3.11	0.79	3.18	0.81	2.71*	3050.61
I am confident that I have the necessary skills and expertise for the technology demands of my future profession.	3.18	0.70	3.30	0.69	5.67*	3761.20

Scale: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

* $p < 0.05$

Among survey respondents who indicated that their primary plan after graduation was to pursue employment (N=2734; 53.9%), 24% reported that they had participated in one internship during their time in college, 16% participated in two internships, and 15% participated in three or more internships. Pell Grant recipients participated in significantly fewer internships (M=2.00, SD=1.299) compared to higher-income peers [M=2.28, SD=1.364; $t(2293.40) = 5.20, p < .05$].

More than 30% of students who planned to pursue employment immediately after graduation participated in undergraduate research during college. When asked how well their undergraduate experience at WU had prepared them for the job market, about half of the survey respondents (52.9%) reported that they were “generally well” prepared and another 29.2% felt like they were “very well” prepared. Among respondents who planned to seek employment immediately after graduation, the results were nearly identical with 53.6% indicating that they were “generally well” prepared for the job market and 27.6% reporting that they were “very well” prepared.

Table 15

Results of t-test and Descriptive Statistics for Self-ratings of Digital Skills Acquisition, by Status as a Pell Grant Recipient

	Pell Grant Recipient		Not Eligible for Pell		t	df
	M	SD	M	SD		
I am confident in my ability to critically evaluate online materials and sources.	3.43	0.60	3.40	0.61	1.68	4917
I am able to effectively communicate ideas and concepts in online and technology-assisted formats.	3.37	0.60	3.38	0.61	0.66	4887
I believe that having strong skills and expertise related to technology is an essential tool when you enter the professional workforce.	3.49	0.60	3.48	0.62	0.15	4876
I have gained new skills and expertise related to technology in my college courses.	3.05	0.80	3.06	0.81	0.42	4867
I have gained new skills and expertise related to technology in my undergraduate research experiences.	3.09	0.79	3.10	0.79	0.17	4184
I have gained new skills and expertise related to technology at an internship or professional experience during college.	3.11	0.81	3.16	0.80	2.11*	4106
I am confident that I have the necessary skills and expertise for the technology demands of my future profession.	3.23	0.71	3.23	0.69	0.02	4885

Scale: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

* $p < 0.05$

Structural Equation Models

This study utilized a model proposed a priori to test the relationship between the skills and experiences that students gain in college and their confidence with regard to transitioning to the workforce after college (see Figure 2). The original model included: personal and background characteristics, several college experience variables, and three latent constructs based on data from the WU senior survey, including students' self-ratings of *Academic Skills*,

Classroom Technologies, and *Digital Competence*. To test the various hypotheses, the model was run separately with two different dependent variables, each with a four-point scale: (1) How well do you think your undergraduate experience at [WU] has prepared you for the job market? and (2) I am confident that I have the necessary skills and expertise for the technology demands of my future profession, (see Table 2). As the previous section highlights, students generally agreed that they were prepared for the job market and the technology demands of their chosen career. In the following sections, I will present summary statistics and the final structural model, and discuss the results in the context of the four hypotheses described in the last chapter.

Observed Variables

As outlined in the previous chapter, the proposed models included eight observed variables (see Table 16). To improve model fit, two variables were recoded as dichotomous, or categorical variables. Specifically, the race/ethnicity variable was recoded to indicate status as an underrepresented minority student (2=URM, 1=Non-URM), and academic division was recoded to indicate a life or physical science major (2=Life or physical science major, 1=Humanities or social science major). Therefore, the three personal and background characteristics were: (1) gender: female, (2) being a Pell grant recipient, and (3) status as a member of an underrepresented minority group (Black/African American, Latino/a, Chicano/a, Native American, and Pacific Islander). The three campus-level experiences included were: (1) being a life or physical science major, (2) participation in undergraduate research, and (3) participation in an internship. The two dependent variables were self-ratings of the extent to which college had prepared students for the job market and their confidence with regard to having the technology skills necessary for one's chosen profession.

Table 16

Observed Variables in Final Structural Models

	N	Percentage	Coding
Female	5326	62.9	2=female, 1=male
Underrepresented minority student	5167	27.9	2=Underrepresented minority student (URM): Black/African American, Latino/a, Chicano/a, Native American, Pacific Islander; 1=Non-URM
Pell Grant recipient	5236	40.7	2=Pell grant recipient; 1=Did not receive Pell grant
Life & physical science major	5028	43.2	2=Life and/or physical science major; 1=Humanities and/or social science major
Internship participant	4837	53.5	2=Participated in internship during college; 1=Did not participate
Undergraduate research participant	5148	36.3	2=Participated in undergraduate research during college; 1=Did not participate
	Mean	SD	Coding
How well do you think your undergraduate experience at [WU] has prepared you for the job market?	3.07	0.58	4-point scale: 1=very inadequately, 2=inadequately, 3=generally well, 4=very well, (excluded: 5=not relevant)
I am confident that I have the necessary skills and expertise for the technology demands of my future profession.	3.23	0.49	Thinking back on your experiences at [WU], indicate your level of agreement with the following statements related to technology (i.e., computers, internet, information and communication technologies, social media): 4-point scale: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree

Structural Model

In this section, I present the results of the conceptual model of digital competencies and career confidence proposed a priori for this study. The model was designed to test four hypotheses related to the study's guiding research questions: (1) that personal background characteristics and contexts will directly and indirectly influence the development of digital competencies, (2a) that students' professional skills development, including participation in internships or undergraduate research experiences, will influence the development of digital competencies and preparation for the technology demands of work, (2b) that students' academic division and self-reported academic skills development in college will influence their development of digital competencies and preparation for the technology demands of work, (3) that students' digital competencies will influence their confidence with regard to professional career transitions. Each hypothesis will be examined individually for the two dependent variables in the model: preparation for the job market, and preparation for the technology demands of work.

Model Fit for Latent Constructs. The first stage of analysis for the structural model was to examine the relationship between the three latent constructs: (1) self-reported academic skills gained in college (Academic Skills); (2) perceived usefulness of classroom technologies (Classroom Technology); (3) self-rating of digital competence (Digital Competence). The model fit indices suggest a moderate fit for the model with the three latent constructs [RMSEA = 0.082, C.I. (0.079, 0.084), CFI = 0.921, TLI = 0.906, $\chi^2 = 3681.98$; Figure 3]. Correlations between the three latent constructs were each significant.

The *Academic Skills* construct was positively correlated with *Digital Competence*, indicating that students who reported gaining general academic skills in college such as critical thinking and quantitative abilities were also more likely to rate themselves highly compared to their peers with regard to digital competencies such as the ability to critically evaluate online information and effectively communicate in online spaces, $r = .274, p < .05$. In addition, students' perceptions of the usefulness of various classroom technologies used in their courses at WU was positively correlated with *Digital Competence*, $r = .146, p < .05$. In other words, students who were confident in their digital competence as compared to their peers were also more likely to indicate that they viewed various digital teaching tools such as online self-tests and visualizations as a positive component of their courses at WU.

Figure 3. Latent Constructs in the Proposed Model

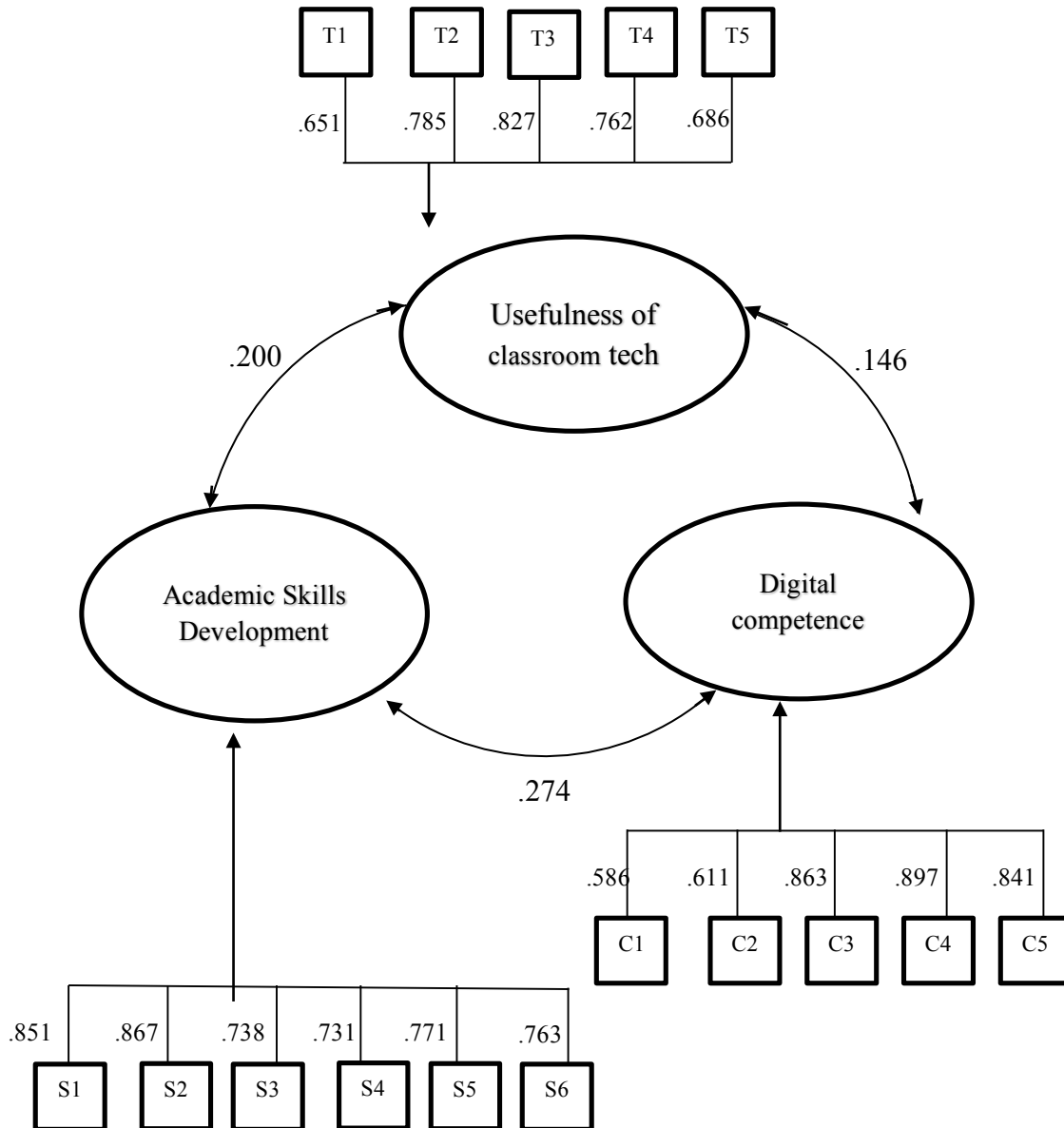
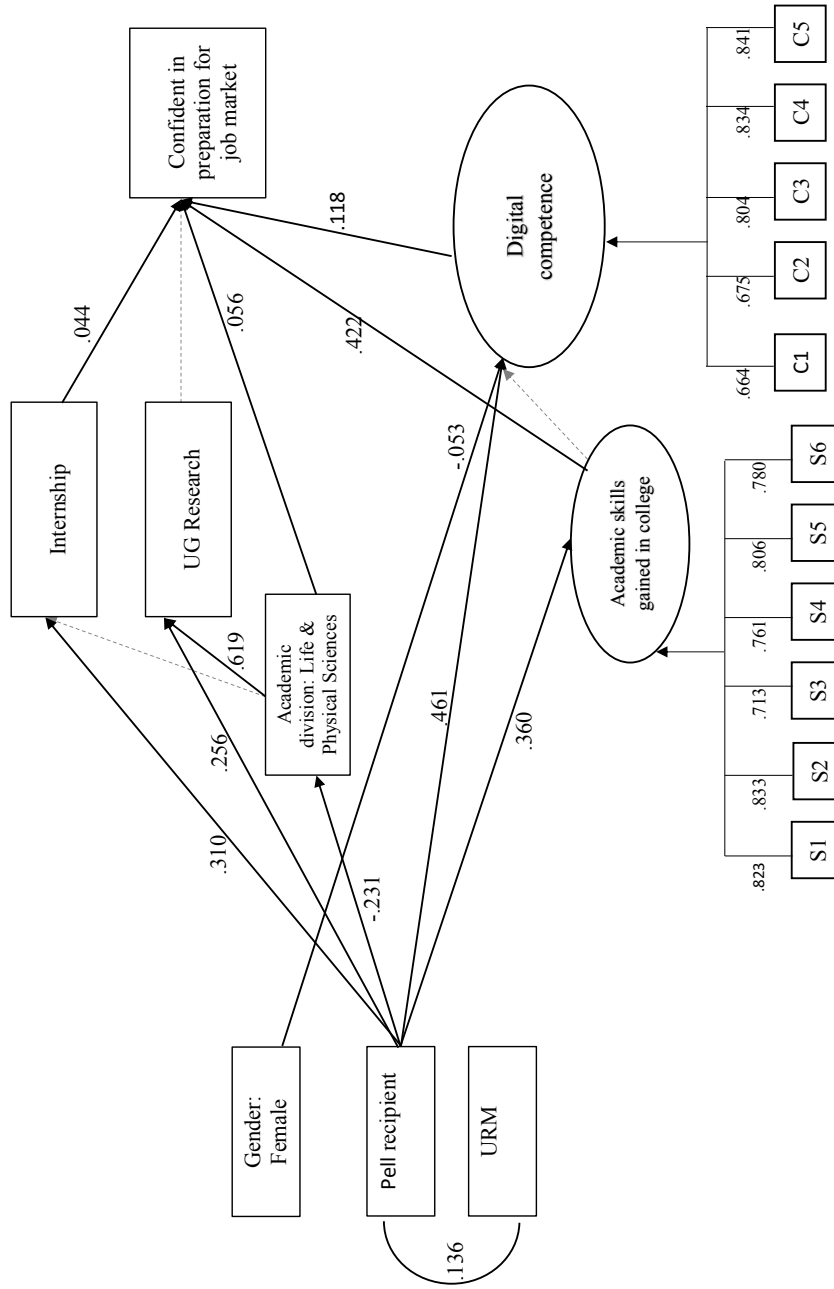


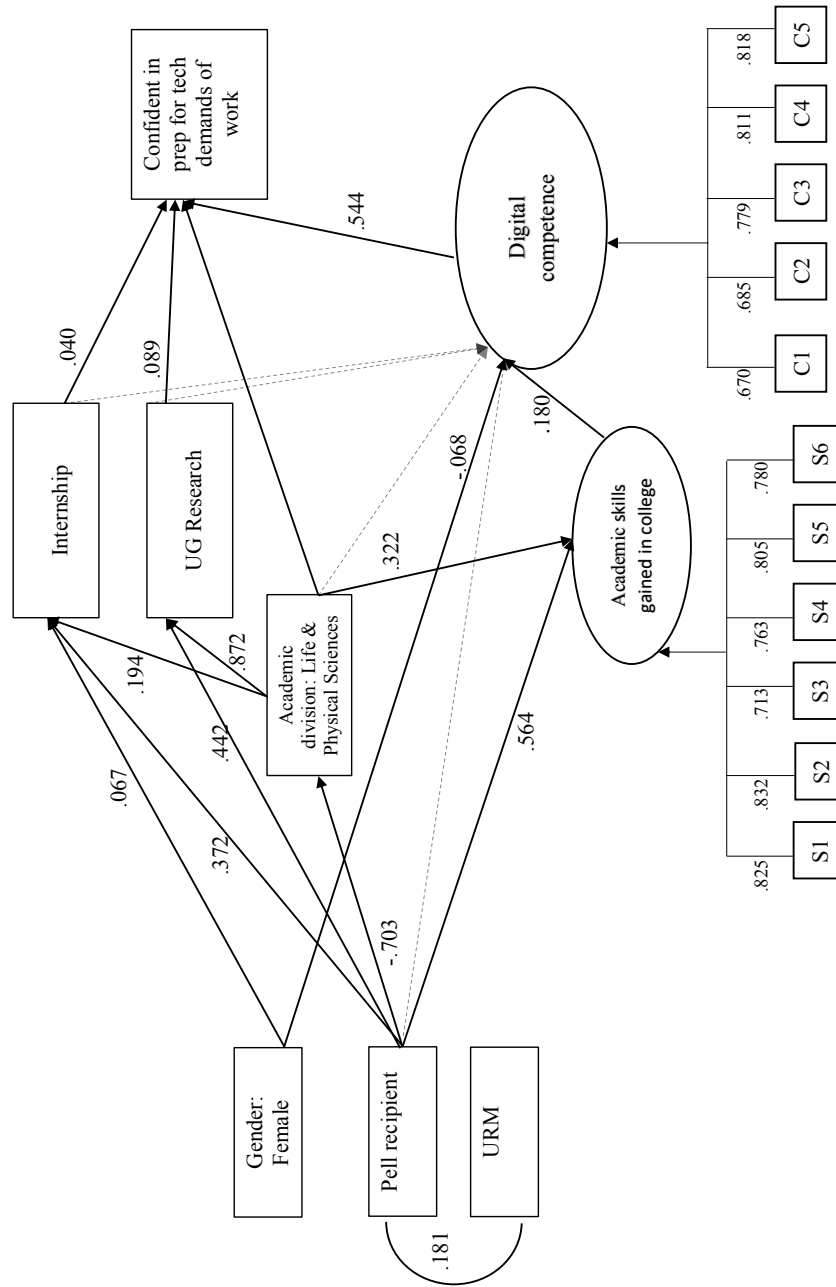
Figure 4. Structural Model Predicting Confidence in Preparation for the Job Market^{1, 2}



¹ Standardized estimates; all paths shown are significant at $p < 0.05$; non-significant paths indicated with dotted line

² RMSEA = 0.024 (CI 0.022, 0.026), CFI = 0.968, TLI = 0.961, $\chi^2 = 521.616$

Figure 5. Structural Model Predicting Preparation for Technology Demands of Professional Work in Chosen Field^{1,2}



¹ Standardized estimates; all paths shown are significant at $p < 0.05$; non-significant paths indicated with dotted line

² RMSEA = 0.032 (CI 0.030, 0.034), CFI = 0.946, TLI = 0.933, $\chi^2 = 799.988$

Overall Model Fit. The proposed model examined the relationship between personal and background characteristics and college experiences and their impact on students' confidence with regard to digital competencies and preparation for the job market. The model was run separately for the two dependent variables of (1) preparation for the job market and (2) preparation for the technology demands of work. The proposed model with all paths was not a strong fit and therefore model modification techniques, including Wald test (Ulman, 2006), were used to improve the fit indices. The latent construct for Classroom Technologies was ultimately removed from the final model along with numerous other non-significant paths, to improve the overall fit. The final models with all significant paths are represented in Figures 4 and 5, with non-significant paths that remained in the model represented by a dotted line.

As stated in the previous chapter, *Classroom Technologies* was a construct based on statements about the usefulness of specific instructional technologies that students encountered in their classrooms. I hypothesized that students' experiences with instructional technologies would vary based on their academic major and that these experiences may influence their confidence with digital competencies. The majority of students did not rate the five tools included in the construct (i.e., blogging tools, online self-tests, visualizations, digital video files, etc.) as highly useful, with mean scores ranging from 2.37 to 3.43 on a five-point scale from never used to very useful. The limited fit of this construct in the proposed model may indicate that students were not using these tools regularly in their classes, or in particularly robust or varying ways. The analysis of students' responses to the open-ended survey question regarding the skills and areas of expertise gained in college further supports this idea, and I discuss these points later in the chapter.

The model fit indices suggest a good fit for the final model predicting students' confidence in their preparation for the job market [RMSEA = 0.024, C.I. (0.022, 0.026), CFI = 0.968, TLI = 0.961, $X^2 = 521.616$; Figure 4]. Similarly, the model fit indices indicated a good fit for the model predicting students' confidence in their preparation for the technology demands of work [RMSEA = 0.032, C.I. (0.030, 0.034), CFI = 0.946, TLI = 0.933, $X^2 = 799, 988$; Figure 5]. Table 17 provides the factor loadings for the latent constructs in the final models for each dependent variable. Missing data was removed from the models using listwise deletion, and therefore factor loadings vary slightly for the two models based on differences in sample size for each outcome. In addition, although the variables in these two models remain constant, the relationship between the variables changes for each outcome. In the following section I will discuss the four hypotheses tested with these models.

Table 17

*Factor Loadings for the Latent Constructs in the Final Structural Model**

	Model predicting preparation for the job market	Model predicting reparation for tech demands of work
	Factor loading	Factor loading
Academic Skills		
Ability to make informed decisions that require analyzing information from many perspectives	0.83	0.82
Critical thinking	0.83	0.83
Confidence in approaching new areas of learning	0.81	0.81
Openness to new ideas and experiences	0.78	0.78
Ability to communicate effectively in writing	0.76	0.76
Quantitative reasoning	0.71	0.71
Digital Competence		
Effective communication skills in online spaces and forums	0.82	0.84
Ability to engage in social media for professional purposes	0.81	0.83
Ability to engage in social media for personal communication	0.78	0.80
Ability to critically evaluate online sources	0.69	0.68
Ability to navigate the internet for academic research purposes	0.67	0.66

* Factor loadings vary based on small changes in sample size for each outcome variable

Influence of Personal Background on Digital Competencies. Research question one focuses on the ways that students’ personal background might influence their confidence with regard to digital literacy. The SEM model included three exogenous variables: gender: female, status as a federal Pell Grant recipient, and status as an underrepresented minority student

(URM). Based on the literature and my own related research, I hypothesized that these factors would influence students' confidence with regard to digital competencies, both directly and indirectly (Hypothesis 1). Status as a Pell Grant recipient and URM status were significantly correlated among students in the sample ($r = .130 / r = .181, p < 0.05$). This study is focused on the experiences of low-income students, and therefore I examined the relationship between status as a Pell Grant recipient and all other variables in the model, controlling for URM student status.

For the model predicting students' confidence in their preparation for the job market, women rated their confidence in digital competence lower than men, controlling for other demographic characteristics and college experiences ($\beta = -0.053$; Table 18; Figure 6). By contrast, Pell recipients positively assessed a greater level of confidence with digital competence compared to their more affluent peers ($\beta = 0.461$). Pell Grant recipients were also more confident in their academic skills development than their higher-income peers, which in turn positively influenced their self-rated digital competence. In the model predicting confidence in one's preparation for the technology demands of work, females again rated their digital competence lower than their male peers, controlling for all other variables ($\beta = -0.068$; Table 19), while there was no significant difference in self-rated digital confidence levels between Pell Grant recipients and their more affluent peers.

Table 18

Parameter estimates for Direct and Indirect Effects in the Structural Model Predicting Preparation for the Job Market

	R ²	B	S.E.	Sig.	Indirect effects	Total effects	Sig.
Major: Sciences	0.053						
Pell recipient		-0.231	0.051	*			
Undergraduate research	0.376						
Pell recipient		0.256	0.054	*			
Major: Sciences		0.619	0.028	*			
Internship	0.095						
Pell recipient		0.310	0.062	*			
Major: Sciences		0.007	0.030				
Academic skills gained	0.129						
Pell recipient		0.360	0.073	*			
Digital competencies	0.277						
Gender: Female		-0.053	0.015	*			
Pell recipient		0.461	0.109	*	0.047	0.509	*
Academic skills gained		0.132	0.070				
Preparation for the job market	0.23						
Gender: Female					-0.006	-0.006	*
Pell recipient					0.215	0.215	*
Major: Sciences		0.056	0.025		0.014	0.070	*
Internship		0.044	0.017	*			
Research		0.022	0.024				
Academic skills gained		0.422	0.012	*	0.016	0.438	*
Digital competencies		0.118	0.014	*			
Pell							
URM		0.130	0.033	*			

* p < 0.05, Chi squared = 521.616 (df=127 p<0.05); RMSEA=0.024 (CI=0.022, 0.026); CFI=0.968, TLI=0.961

Table 19

Parameter Estimates for Direct and Indirect Effects in the Structural Model Predicting Preparation for the Technology Demands of Professional Work in Chosen Field

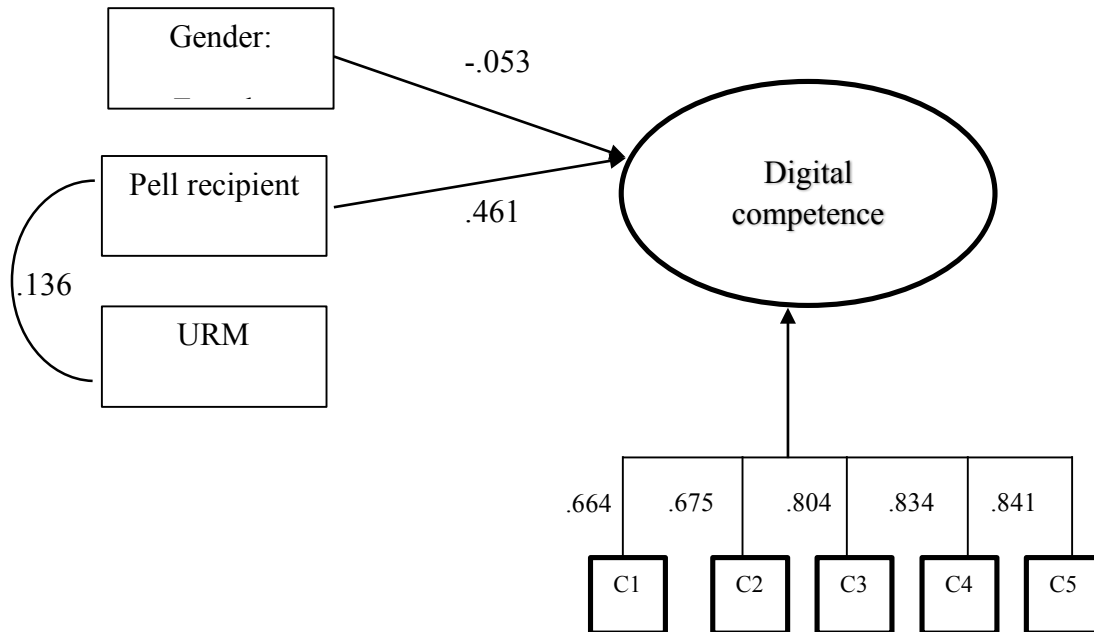
	R ²	B	S.E.	Sig.	Indirect effects	Total effects	Sig.
Major: Sciences	0.494						
Pell recipient		-0.703	0.103	*			
Undergraduate research	0.414						
Pell recipient		0.442	0.108	*			
Major: Sciences		0.872	0.113	*			
Internship	0.079						
Gender: Female		0.067	0.018	*			
Pell recipient		0.372	0.085	*			
Major: Sciences		-0.194	0.089				
Academic skills	0.167						
Pell recipient		0.564	0.127	*	-0.226	0.380	*
Major: Sciences		0.322	0.133	*			
Digital competencies	0.214						
Gender: Female		-0.068	0.015	*	0.003	-0.065	*
Pell recipient		0.483	0.323		-0.110	0.373	*
Internship		0.043	0.046				
UG research		-0.074	0.083				
Major: Sciences		0.275	0.288		0.002	0.277	
Academic skills gained		0.180	0.086	*			
Prep for tech demands of work	0.314						
Gender: Female							
Pell recipient					0.197	0.197	*
Major: Sciences							
Internship		0.040	0.017	*	0.024	0.063	*
Research		0.089	0.017	*	-0.040	0.049	
Academic skills gained					0.098	0.098	
Digital competencies		0.544	0.010	*			
Pell							
URM		0.181	0.045	*			

* p < 0.05; Chi squared = 799.988 (df=124 p<0.05); RMSEA=0.032 (CI=0.302, 0.034); CFI=0.946, TLI=0.933

As previously stated, female students often report lower levels of confidence in their general academic and computing skills as compared to their male peers. Research points to a number of factors that might influence women's limited participation in computing fields and lack of confidence with regard to their computing skills, including differential access to opportunities to gain advanced computing skills before college (Frieze & Quesenberry, 2015; Margolis, 2010; Varma, 2006) and the unwelcoming culture of computing and STEM fields in college (Colatrella, 2011; Frieze & Quesenberry, 2015; Gasiewski et al., 2012) and in professional careers (Duran and Lopez, 2015).

Additionally, as Sims's (2014) concept of differentiating practices points out, young people gain specialized digital skills as participants in different communities of practice as they match strategies and uses for information and communication technologies (ICT) with particular outcomes of interest. In this sense, many women may participate in communities of practice that use computers and ICT in different ways than their male counterparts. For example, young (mostly white and Asian American) boys are more likely to engage in "gamer" culture than young girls, which is often associated with developing young people's interest in coding and computer programming (Fisher & Jenson, 2017; Fraser, Shane-Simpson, Asbell-Clarke, 2014; Kafai & Burke, 2014).

Figure 6. Influence of Background on Digital Competencies, for Model Predicting Preparation for the Job Market



Pell Grant recipients reported higher levels of confidence in their digital competencies compared to their higher-income peers, controlling for all other variables. This finding may be explained, to some extent, by looking at the individual measures in the latent construct. Students were asked to rate their abilities relative to “the average person your age” and also to “think back on their experiences” in college. Lower-income students may feel that their digital skills have improved more during college based on their level of skill at entry and that after college their skills are comparable or even more advanced than other young people their age both off and on campus. These students may have sought out more opportunities to gain digital competence during college compared to their higher-income peers, or this more significant change could be attributable to the fact that higher-income students entered college with greater confidence in their digital skills and therefore had less room for growth. Further, the indirect relationship

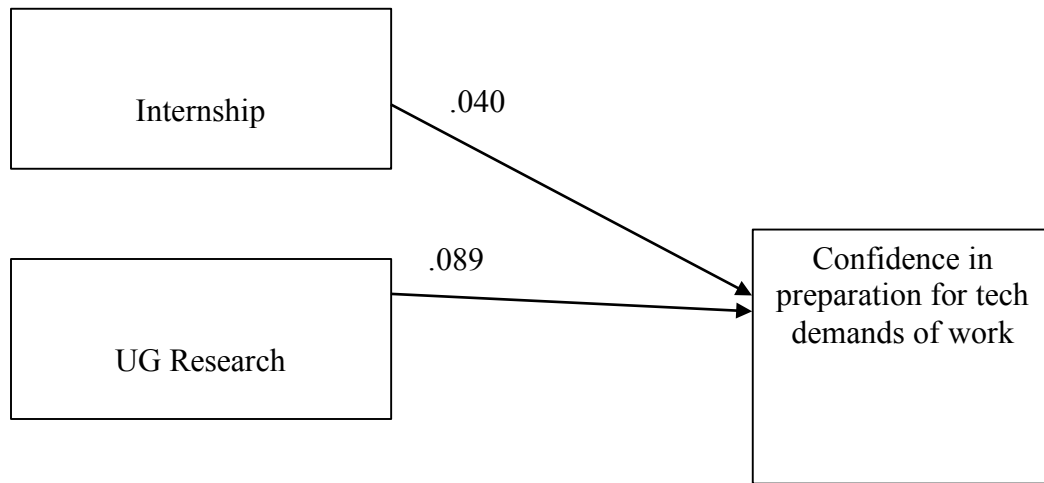
between digital competencies and Pell-recipient students is mediated by self-confidence in one's academic skills gained in college. In both models, Pell Grant recipients assessed greater change in their academic skills during college (i.e., critical thinking, making informed decisions, confidence in approaching new areas of learning; $\beta = 0.360$ in Figure 4 and $\beta = 0.564$ in Figure 5) compared to their more economically advantaged classmates.

Professional Skills Development and Digital Competencies. The second research question focused on the ways that particular experiences and interactions in college influence the development of digital literacy. The structural model included four endogenous variables related to experiences in college: (1) a latent construct for self-reported academic skills gained during college, (2) participation in an internship, (3) participation in undergraduate research, and (4) academic division: life sciences, physic sciences, humanities and social sciences. I hypothesized that students' participation in pre-professional activities such as internships and undergraduate research would influence the development of digital competencies and their preparation for the technology demands of work (Hypothesis 2a). All paths were tested and some non-significant paths were removed to improve overall fit.

Based on the final model, participation in undergraduate research and internships were not significant predictors, directly or indirectly, of confidence related to digital competencies in either of the final models. Even though students' experiences with undergraduate research and internships may provide them with hands-on training and support related to their chosen field, they did not necessarily influence students' broad-based digital competencies. This result could indicate that students are not gaining more specialized technical skills during these experiences that would enhance their digital competence.

Research experiences and internships were both positive predictors of students' feelings of preparation for the workforce and the specific technologies they are likely to encounter in their career (see Figures 4 and Figure 5). In the model predicting confidence with the technology demands of work, participation in an internship ($\beta = 0.040$) and undergraduate research ($\beta = 0.089$) both had a direct positive relationship with the dependent variable (Figure 7). This is not particularly surprising considering that these types of experiences are geared toward helping students gain knowledge about professional opportunities and specialized skills for their chosen field, but it is interesting to note that these experiences were positively related to students' feeling about technology in the workplace. Regardless of one's specific career path, students expect to encounter a certain level and diversity of information and communication technologies at work, and they see the value in hands-on experiences in college that connect their classroom learning with practical skills and expertise.

Figure 7. Influence of Pre-Professional Experiences on Career Confidence, for Model Predicting Preparation for the Technology Demands of Work

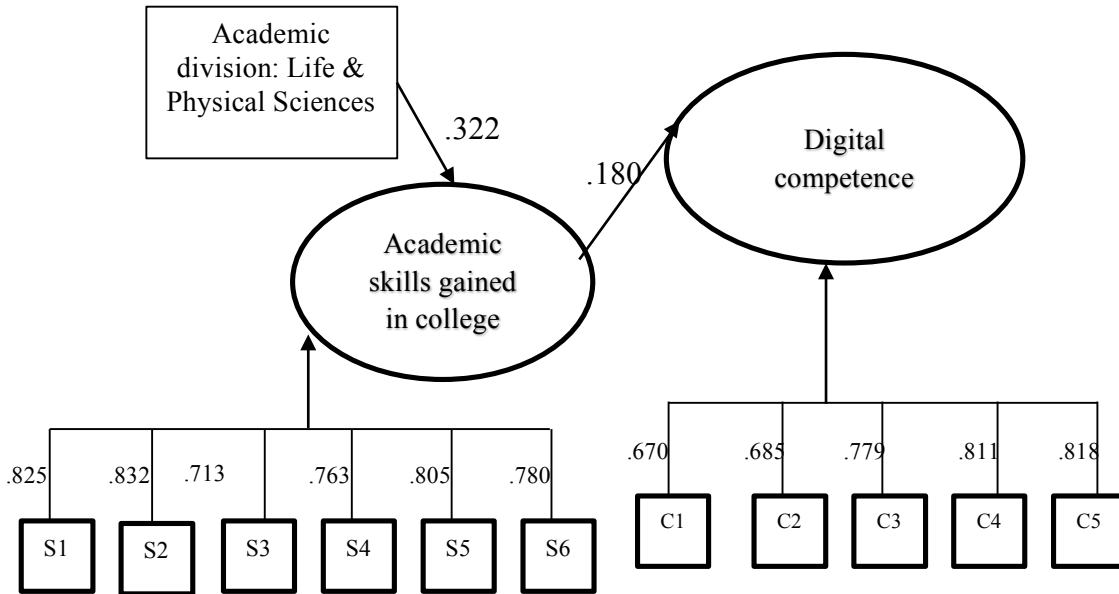


A second hypothesis related to this research question was the belief that students' academic division and academic skills development would influence their digital competencies and preparation for the technology demands of work, both directly and indirectly (Hypothesis 2b). As previously stated, in the final model *Academic Division* was a bivariate indicator of an academic major in the life and physical sciences, as compared to humanities and social sciences. Students' status as a life or physical science major did not have a significant influence on digital competencies in either model. Yet, both academic division and the latent construct for academic skills developed in college had an indirect influence on digital competencies and preparation for workplace technologies.

Life and physical science majors reported confidence in their digital competencies through academic skills development ($\beta = 0.058$, $p < 0.05$; Figure 8). In other words, life and physical science majors reported stronger gains in their academic skills during college in the form of enhanced critical thinking skills and understanding of diverse perspectives. Gaining

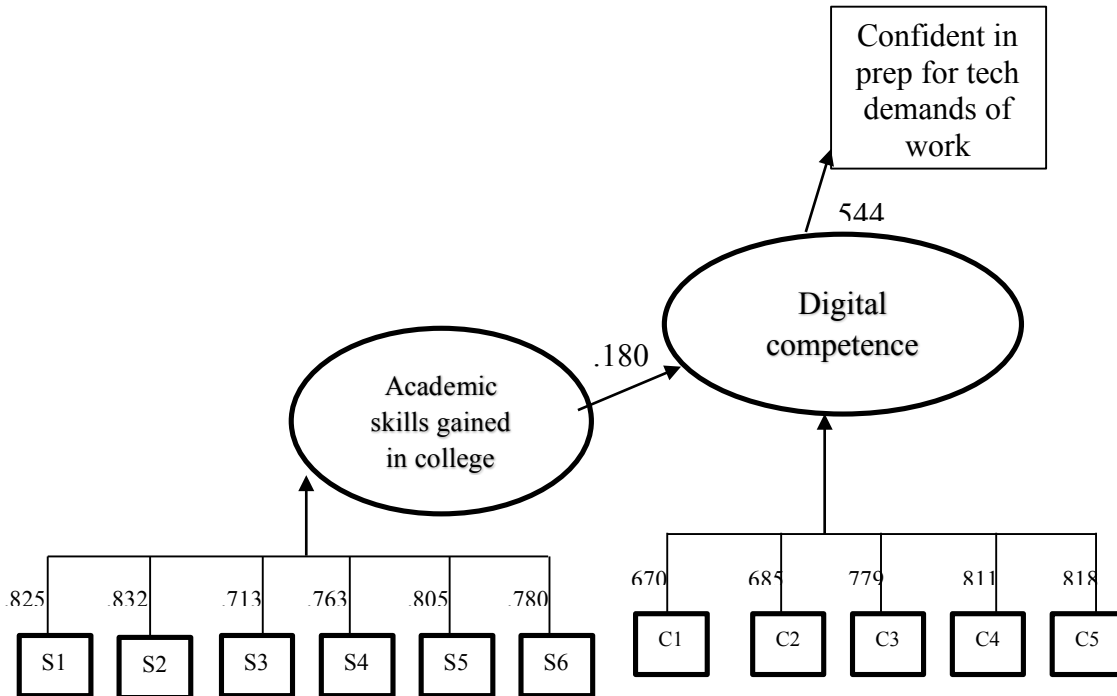
academic skills was also correlated with greater confidence in their digital competencies such as the ability to critically evaluate information online and being able to communicate effectively in digital spaces and through social media. The positive relationship between academic skills development and greater confidence in one's digital competencies suggests that students in science majors are using foundational digital tools and skills to support their academic work in college. As members of a generation who have grown up with computers and the internet, most college students regularly use online tools and computer applications to work on assignments and projects. As students advance their academic skills in college and learn to apply them to specific tasks and domains of practice, they are also sharpening their digital competencies in this context. For Martin (2008), digital usage involves the application of digital competencies within specific domains, such as academic or professional communities.

Figure 8. Relationship between Academic Division and Digital Competencies, for Model Predicting Preparation for the Technology Demands of Work



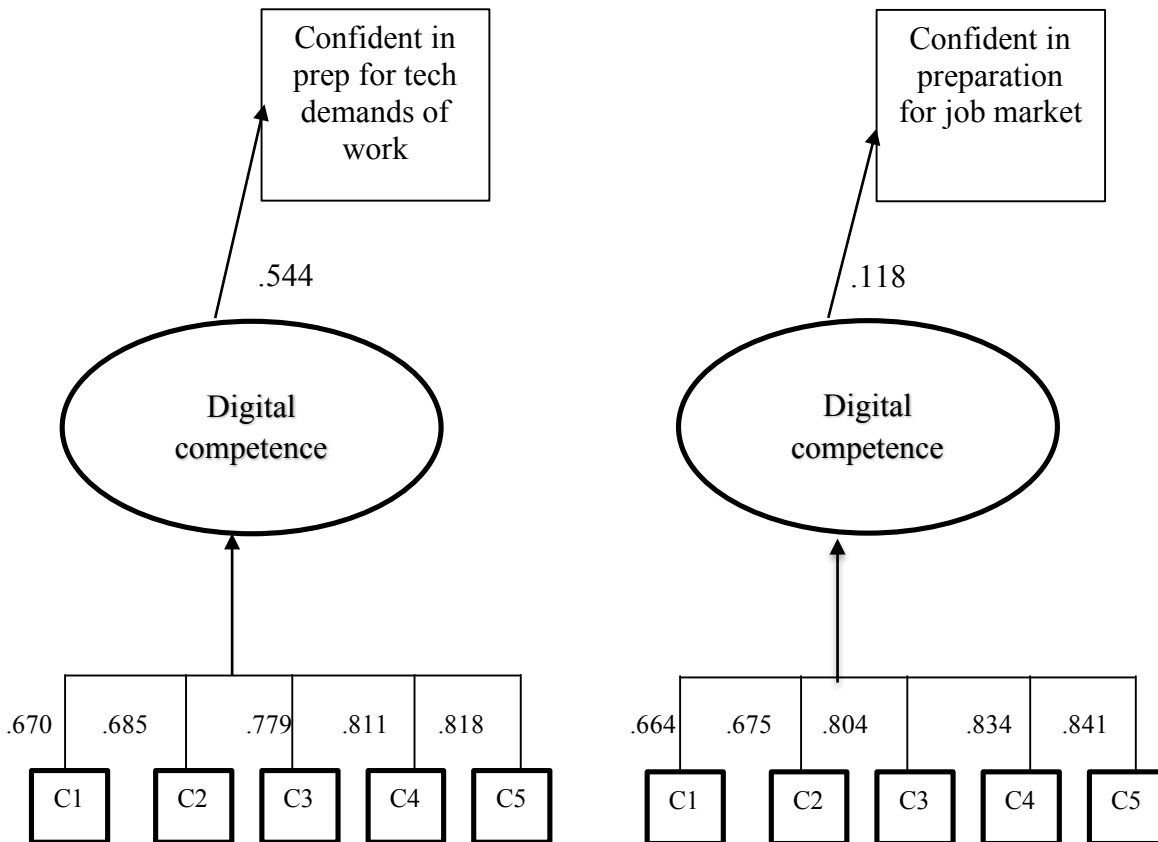
This idea can be further illustrated by Figure 9 which highlights the relationship between students' academic skills, digital competencies, and confidence related to workplace technologies. Students who reported positive gains in their academic skills and digital competencies in college were more confident that they had the necessary skills for the technology demands of their chosen career ($\beta = 0.098$, $p < 0.05$; Figure 9). According to Arthur et al. (1999), career capital is the accumulation of educational, professional, and life experiences that contribute to career advancement. These findings indicate that students are making connections between their academic experiences in college and their career plans, and, at least to some extent, gaining the skills they need to begin or continue their professional journey.

Figure 9. Relationship between Academic Skills and Career Confidence, from Full Model Predicting Preparation for the Technology Demands of Work



Preparing for the Demands of One’s Chosen Career. Examining the relationship between students’ experiences in college and their confidence in transitioning to the workforce is of central concern to this study. As such, the third research question focused on the influence of students’ digital literacy on professional career planning. For the structural model, I hypothesized that students’ digital competencies would influence their confidence in professional career planning (Hypothesis 3). As Figure 10 illustrates, students’ self-reported digital competencies predicted greater confidence in the extent to which students felt prepared for the job market ($\beta = 0.118$) and the technology demands of work ($\beta = 0.544$). These results indicate that students see a connection between their ability to navigate information and communication technologies (ICT) and the demands of the workforce, regardless of their career path.

Figure 10. Influence of Digital Competencies on Career Confidence, from Full Model Predicting Preparation for the Technology Demands of Work



As Martin's (2008) three-tiered framework of digital literacy highlights, digital competencies merely represent the baseline for the types of specialized skills that most students will need to master for professional advancement, and do not necessarily constitute high levels of digital literacy among respondents. Yet, one must have these digital competencies to advance to the second level of the framework – digital usage – and begin to put them to use in specific domains or communities of practice. In the structural model, the positive relationship between

students' confidence in their digital competencies and their preparation for the job market indicates that they may also see the connection between these skills in their chosen profession and feel that they can build upon these basic skills to develop more career-specific digital usage.

In the following section, I share some of the major themes that emerged from students' open-ended responses on the same survey about the ways that college has prepared them for the types of technology that they will use in their chosen career.

In Their Own Words: Experiences that Prepared Students for the Workforce

Senior survey participants were asked to respond to a number of open-ended questions, with one item having particular relevance for this study: How have your experiences at [WU] helped to prepare you for the technology demands of your future profession? Technology had been defined for the group of questions as: "computers, internet, information and communication technologies, social media, etc." and some examples of technology skills were provided including, computational skills, online marketing, and presentation skills. Students' responses to this question helped to answer two of the guiding research questions:

- What experiences and interactions during college influence the development of digital literacy among students?
- In what ways does digital literacy influence college students' academic choices and professional career planning?

More than 40% of students responded to the open-ended survey question providing a rich source of information to shed light on both the kinds of digital skills that students gained in college and their expectations for the technology demands of their future career. Students' responses were quite variable considering the broad scope of the question, but a number of major themes

emerged that provide further insight to the development of the second phase of this study. A total of 2230 survey respondents commented on this question but 53 stated only “NA” and were therefore excluded from analysis. Respondents to the open-ended question were very similar to the overall survey sample and therefore provide a representative sub-group for analysis (see Tables 9 and 20).

Table 20

Characteristics of the Sample, Open-ended Responses
(N=2177)*

	Percentage
Female	66.4
Pell Grant recipient	40.7
Transfer student	35.4
Division: Humanities	11.7
Division: Social Sciences	41.2
Division: Life Sciences	27.5
Division: Physical Sciences	12.0
Plans for employment	54.9
Plans for graduate/professional school	33.0

* Excludes "NA" responses, available demographic data included and calculations based on sample size of 2177

Tech Skills for Work and Life

More than 600 students reported that they had gained foundational digital competencies that would be useful to their professional career, such as online collaboration, communication, and information gathering (Table 21). For example, one student said, “I am now prepared for anything relating to a lot of the basic programs such as Excel, PowerPoint and a few others. I can use them effectively in communicating and ensuring assignments are done in a timely manner.” Within this category, the majority of respondents talked about their ability to present and share information with colleagues and various audiences. As one student commented, “My experiences

at [WU] have reinforced my presentation skills, especially with regard to presenting research findings in conjunction with visual aids while addressing an academic audience.” Many students felt that the ability to utilize technology to share information with their colleagues was an important skill that they could use in any work setting and also in finding a job. “I feel like I learned more about presentations to help me realize how I would conduct myself perhaps during an interview,” another commented.

Other students were less positive, indicating that they had gained only general digital skills for the workforce, such as Microsoft Office Suite, and not more advanced career-specific tools. “I think that generally, my classes at [WU] have not really focused on technological proficiency in any sort of manner. An exception might be making presentations, through PowerPoint or Prezi, and delivering them in a class setting,” said one student. Another commented, “Not much? I guess I learned how to do better PowerPoint presentations, but that was more self-taught than any learning experience provided within a class.” Overall, there was limited consensus about the value of incorporating specific technical skills into classroom experiences.

Among respondents who commented on gaining digital competencies, lower-income students were more likely than their higher-income peers to report gaining new skills related to internet navigation and online information gathering, website design, learning new programs and applications, developing professional networks, and online writing and communication. They were less likely to report gaining skills in data analysis and using Excel. Additionally, students talked about “networking opportunities,” “connections,” and an “understanding of the industry” among the skills they gained. “I have learned how to write professional emails, how to sell

yourself in a resume, and how to make a good presentation,” said one student. Another commented,

I will be working in the field of education, so I do not believe I need to have extensive preparation in technology. But I do believe it is important for network and presentation skills. [WU] has not provided much in the technology sense for education, but I have learned a lot about professionalism.

This last statement highlights another interesting factor among responses, namely that there were significant differences in the extent to which students feel that they will use information and communication technologies and career specific tech skills to support their professional career.

Although it is difficult to know whether or not students have a strong working knowledge of the kinds of digital competence they will need for their specific career, research indicates that new professionals would benefit from being able to navigate a range of digital tools regardless of their field (Brynjolfsson & McAfee; 2014; Toyama, 2015). This student who plans to work in the field of education may not be required to master advanced technical skills to land her first job, but there is a good chance that, depending on her specific career goals, she will incorporate digital tools into her teaching or use it to support her research or administrative work. In addition, it is telling that nearly a third of students who responded to this question about the experiences in college that have best prepared them for their future careers discussed such basic tools as Microsoft Office applications and Google Docs, or the ability to write a professional email. This indicates that students either did not have the opportunity to use more career- and field-specific digital tools during college, or they are struggling to articulate the ways that these experiences and the skills they gained could be useful and marketable skills for the workforce.

Table 21

*Coding Scheme for Students' Open-Ended Responses Regarding College Experiences That Prepared Them for Technology Demands of their Future Career (N = 2177)**

Themes	Sub-themes	Total responses	Total responses
Job skills, general (Microsoft Office; Google Drive; online collaboration tools; general communication skills)		616	
	Presentation skills		420
	Data analysis, Excel		98
	Communication skills, writing		89
	Web, internet navigation, info search		58
	Collaborative projects, teams		48
	Marketing		41
	Social media		29
Coursework, positive and negative		459	
	Discipline specific skills		197
	General positive; gained skills		196
	General negative; tech not used; no skills gained		108
	Presentations, projects, research		86
	Need for more classes, resources on campus		73
	General mixed, positive and negative		43
	Major doesn't require or use tech; need for tech focus		37
General negative (e.g., no; it hasn't; didn't learn much)		352	
Expectations for work demands		285	
	Helped to prepare; confident		130
	Feel unprepared for work, etc.		96
	Don't need tech, much tech		41
	General skills for all jobs		32
Research skills		209	
	Information gathering		100
	Statistical software, data analysis		43
	Presentation skills, sharing research		28
General, positive (e.g., yes; very well; learned a great deal)		182	
Coding, computer science skills		149	
	Confident in coding skills		59
	Computing courses for non-majors		20
Campus experience, outside of class		145	
	Campus work experience		55

Clubs, extracurricular activities	55
Outside sources, non-campus	122
Self-taught, gained skills to teach myself	56
Gained skills at work, not campus	28
Internship, volunteer	48
Pre-college, already had skills	22
General mixed, positive & negative (e.g., yes & no; somewhat)	116
Adaptability, confidence to learn new things	92
Practical, hands-on experience	39

**Table excludes codes with less than 20 related responses*

Career- and Discipline-Specific Skills

The second most common theme among the responses related to students' experiences in their academic courses (N=459; Table 21). Respondents made both positive and negative comments about the kinds of digital tools they encountered in classes, but more than half discussed discipline-specific skills that they anticipated using to support their career. As one student stated,

My experiences at [WU] have prepared me for the technology demands of my future profession by providing step-by-step instructions when using programs related to my field. Overall, my experience in the labs have not only taught me how to use the program, but how to translate results into everyday discussion.

Another student commented on a specific course, stating, "I took an Audio Technology course that helped me understand what it means to produce music for a living... After the course, I felt enlightened but getting to the end of the course was no easy task." These two students were able to connect their classroom experiences directly with the challenges they expect to face in the workforce.

Building confidence in their current skills and the ability to continually gain new competencies as necessary was of central importance to many respondents. “I worked a lot using the chemistry programs, ChemDraw and Chem3D. I originally wasn't very good with technology, but after using these two programs I feel a lot more confident with various computer programs,” commented one student. Another said, “Considering I am seeking out a career in GIS / Remote Sensing which has high technology demands I am quite confident with my skill level due to courses I participated in at [WU].” For Martin (2008), digital literacy is the ability to translate digital competence, or basic computer and ICT skills, into relevant skills for a specific domain of practice. In these two examples, the students has applied their digital competencies to a specific career field by mastering computer software and other digital tools that support their work in this area.

Students also connected broad-based skills such as critically evaluating online materials and presentation skills to their specific careers. As one student explained,

Most of my science courses and extracurricular research work – through the use of online research to find pertinent articles, assignments where research articles were critiqued, and assignments where students peer-reviewed each other's work – taught me how to critically assess the content and validity of research papers found online. I believe this skill will be essential in my future career as a physician because it is the responsibility of a scientist to be able to quickly and correctly identify useful new knowledge.

For another student, her courses provided an opportunity to build upon existing skills in marketing and web analytics and “apply many different web tools, programs, and technologies during [her] studies at [WU] (especially with the Digital Humanities class...) and feel that [she was] equipped to become a more well-rounded professional in the future.” These students’

ability to articulate the connections between general digital competence and the application of these skills in a specific field further supports the idea that some students are beginning to develop digital literacy in their classes and during college.

Although the majority of comments related to discipline-specific skills and competencies in academic courses were positive, some students indicated that their coursework didn't prepare them for the technology skills they anticipate needing in their career field. Lower-income students were more likely than their higher-income peers to report negative experiences with technology or not gaining new skills in their classes, while higher-income students were more likely to indicate that they wanted more resources and classes on campus to help them gain new ICT skills. One student commented,

I think the things I learned at [WU] will help me with [my job as a software developer], though I think the structure of courses overall is suboptimal for producing technically competent graduates. There should be even more emphasis, particularly in CS, on more group-based projects and less on test taking.

Another said, "In all honesty, my courses have not emphasized technology. I would have appreciated more exposure to Excel and Microsoft Office, coding, and website design, but that was not something ever offered through my courses."

Most students linked this lack of field-specific technology training to their academic department. According to some students, this lack of technology integration in their classes was not surprising given their academic major. In reference to their preparation for the tech demands of work, students said things like, "Not really, I'm a psychology major" and "My classes really didn't teach me anything in the technology realm that is applicable to a professional career. I'm an English major, most of the time we are stuck in the 1800s." Another said, "Outside of

research, readings, and basic office tools the history department hardly uses technology. This seems to come from an unwillingness of professors to fully utilize technology themselves.” Yet, there was no consistent pattern across academic divisions since many students in the Humanities and Social Sciences reported rigorous use of technology related to their career fields and some students in STEM majors wanted to learn more about discipline-specific digital tools.

For example, one respondent commented that, “As a philosophy major, my experiences at [WU] have helped improve my research and writing skills by way of computer use.” Several students also remarked on the skills they had gained through courses in Digital Humanities, such as: “Taking Digital Humanities courses has exposed me to a variety of technologies.... These classes have allowed me to feel comfortable learning new technology in a short period of time and have given me knowledge on what resources to take advantage of... to accomplish a task.” Meanwhile, another student commented, “My major is Applied Math and although a programming course is required for the major, it only introduces us to introductory coding. But there hasn't been an extensive use of other important applications like Excel and PowerPoint... Most of my classes have written final exams.” Another explained,

The Economics department did not provide any basic instruction for programs such as Excel but would use the programs for homework assignments, forcing students who did not know the program to suffer... There was absolutely ZERO prep by the department... for the technology demands of a future profession.

The latter comment illustrates one of the problems in assuming that all students enter college with a basic understanding of common programs such as Word, Excel and PowerPoint. This point is further supported by the fact that the most common theme among open-ended responses related to students gaining these basic skills.

Collectively, students' responses point to a need for academic departments and faculty to make intentional choices about their use of discipline-specific technologies to support student learning and preparation for the job market, and to articulate these decisions to their students. Further, faculty could do more to help students make the connection between the broad-based digital skills that they gain in classes (such as critical analysis of online information, research and collaboration tools, and social media engagement) and their potential application in professional settings. Very few students indicated that they didn't want information and communication technologies integrated into their coursework, although as this discussion highlights many students value the ability to use technology to support critical thinking, research and analysis, and communication. The challenge for educators and new graduates entering the workforce is finding ways to ensure that they move beyond basic competencies and develop digital literacy to support and enhance their professional and academic work.

Discussion

The central aim of this first phase of the study was to gain a better understanding of what factors influence the development of digital competence among college students and how that relates to their feelings of confidence and readiness for the workforce. As previously stated, I was particularly interested in the experiences of lower-income students, as defined by status as a Pell Grant recipient, and how their perspectives might differ from those of their higher-income peers. By using data from the annual survey distributed to all graduating seniors at WU, I was able to look at a large sample of students and consider the relationship between various student characteristics and college experiences in predicting confidence in digital competencies and preparation for the workforce. A number of interesting findings emerged, which contribute to our

understanding of digital literacy among college students, and informed the development of the second phase of this study.

Responses to both the scaled and open-ended survey questions indicate that students were generally confident in their digital competencies, as defined by Martin (2008). Most students felt that their skills were “average” to “above average” in comparison to their peers for things like critically evaluating online information, navigating the internet for academic research purposes, and communicating in online spaces and formats. Students’ responses to the open-ended question about the experiences in college that helped to prepare them for the tech demands of their chosen career further supported this trend. Nearly 30% of students responded to this question by talking about general digital skills that could be used in a wide range of professions such as giving presentations or using online collaboration tools like Google Docs. Many students felt that these skills would be useful in any professional setting and did not necessarily comment on their own career path. Less than 10% of students linked their digital competencies directly to discipline-specific skills they anticipated needing for their own career after college.

As “digital natives” who have grown up with computers and the internet it is not surprising that graduating seniors at a highly selective research university would be comfortable with their ability to navigate a range of basic tasks using ICT. It was interesting to note though that survey respondents were less confident in their skills related to computer programming and website design. Only 20% of respondents reported that their skills were above average compared to their peers, with mean scores indicating that most students felt that they were “below average” or “average.” Lower-income students, or Pell Grant recipients, were significantly less confident in these more advanced skills compared to their more affluent peers, and women reported lower levels of confidence compare to their male peers.

While there has been a substantial push in recent years to incorporate computational thinking and programming languages into school curriculum and to give a wider range of students the chance to learn basic coding, the majority of students still do not encounter these opportunities in school. At the same time, the results align with research indicating that students in less-resources school and in lower-income neighborhoods are not moving beyond basic computing activities in their classes (Margolis, 2010; Shank & Cotton, 2014; Warschauer, Cotton & Ames, 2011). Similarly, female students are less likely to engage in computing activities that may lead to an interest in computer science at the undergraduate level (Colatrella, 2011; Frieze & Quesenberry, 2015).

Sims (2014) argues that young people gain specialized skills and perceptions, or digital literacy, in communities of practice with their peers. Therefore, if higher income boys are more likely to tinker with computers, engage in online gaming communities, and learn to code at a young age (Duggan, 2015; Fisher & Jenson, 2017; Kafai & Burke, 2014), then it would follow that this encouragement translates to more confidence in these skills that sticks with them into college. Additionally, the assumption among some students that they do not need advanced computing skills for their chosen career field may stem from these early experiences and the attitudes they developed about the kinds of individuals who pursue and participate in technically oriented professions.

Despite these differences in confidence in programming and design skills among some groups, students generally felt that they had gained relevant skills for their chosen career field during college. More than half of students “strongly agreed” that digital competence was an essential tool when you enter the professional workforce, and more than 80% of students reported that they were “generally well” or “very well” prepared for the job market. In the

structural model predicting both preparation for the job market and preparation for the technology demands of work, Pell Grant recipients reported stronger gains in academic skills during college as compared to their higher-income peers. As previously stated, these findings could indicate that lower-income students enter college with lower levels of confidence in essential academic skills such as critical thinking, quantitative skills, and writing skills (e.g., Bailey & Dynarski, 2011; Chang et al., 2014), and therefore attribute more substantial gains in these areas to their experiences in college. Conversely, higher-income students may feel confident in these areas when they enter college and therefore attribute less improvement to their undergraduate years. Students may also seek out different opportunities to gain new skills during college based on their confidence levels at entry. There were no major differences in responses to the open-ended question among lower- and higher-income peers, although Pell Grant recipients were more likely to report that they had gained skills in navigating the internet and online materials, communicating online, and developing professional networks.

In the structural model predicting preparation for the job market, Pell recipients were more likely to rate themselves highly in *Digital Competence* compared to their same age peers. Being a Pell Grant recipient was also predictive of greater confidence in *Digital Competence* through the *Academic Skills* construct for both the structural model predicting preparation for the job market ($\beta = .047, p < .05$) and the model predicting preparation for the tech demands of work ($\beta = .101, p < .05$). This relationship may indicate that students are using digital skills such as navigating the internet, online communication, and evaluating online resources to support their academic work. As they use these digital tools to engage in academic communities of practice in college – in classes, with clubs and organizations, and through other activities – students are developing digital literacy, as defined by Martin (2008).

At the same time, participation in an internship or undergraduate research during college were not significantly related to *Digital Competence* in either structural model (Figures 4 and 5). This finding is somewhat problematic in the sense that these hands-on experiences could be an exceptional community of practice for students to gain digital literacy and specific technical skills, along with career capital, for their chosen career path. Career capital (Arthur et al., 1999; DeFillipp & Arthur, 1994) is made up of three interdependent competencies of knowing-why, knowing-how, and knowing-whom. Internships and undergraduate research, and many other hands-on experiences in college, can provide students with an opportunity to refine their career goals (knowing-why), gain practical skills and competencies (knowing-how), and interact with professionals working in the field to gain insight and start to develop a network of colleagues and contacts (knowing-whom).

Among respondents to the open-ended question, 15% talked about their research or work experiences on campus that provided them with hands-on experience using digital tools, yet for many research participants the skills they gained were more closely aligned with graduate school admission than career advancement. For many students, this lack of specificity may stem from the fact that they aren't sure what their future career would entail. For others, their professional goals may be clear but they were unaware of the demands of the workplace and the kinds of technical skills they would need to succeed and advance. Digital literacy is based on the assumption that an individual has mastered a range of digital competencies and can utilize these skills to accomplish tasks in their specific community of practice. In this sense, students who commented that their basic skills would be useful for any job may be on the right track even if they haven't articulated a specific skillset to support their professional work. It is difficult to

parse out these differences without more in-depth information, and therefore the qualitative interviews in the second phase of this study will help to further illuminate these ideas.

In the structural models, participation in undergraduate research ($\beta = .089, p < .05$) and internships ($\beta = .040, p < .05$) were significantly related to students' feeling of confidence in their preparation for the technology demands of their chosen career field, controlling for all other variables in the model. Participation in an internship was also positively associated with students' confidence in their preparation for the job market ($\beta = .044, p < .05$), although participation in undergraduate research was not significant in this model. While Pell Grant recipients were less likely than their higher-income peers to complete an internship during college, for those who did it was positively related to career confidence. Completing an internship was positively associated with Pell Grant recipients' feelings of confidence in their preparation for the job market ($\beta = .014, p < .05$) and their confidence with regard to the tech demands of work ($\beta = .015, p < .05$), controlling for all other variables. In this sense, lower-income students who participate in these professional development experiences gain access to an important community of practice where they can interact with professionals in their field, receive mentorship and guidance, and build career capital.

Greater confidence in one's digital competencies was positively related to students feeling more confident in the extent to which their college experience had prepared them for the job market, as well as the technology demands of their chosen profession. This finding indicates that students see a connection between their academic experiences on campus and the demands of the professional workforce. At the same time, students experience participating in internships and undergraduate research were not highly correlated with digital competence. While this result could indicate that students are gaining more applied digital skills during their internships and

research experiences, it also highlights the need for more robust measures of students' learning outcomes in these settings and the opportunity to help students draw out the connections between these hands-on experiences and the kinds of skills they will need as they transition to professional work environments after graduation.

CHAPTER 5: FINDINGS FROM PHASE II

The second phase of the study was informed by the analysis of senior survey data discussed in the previous chapter and involved individual interviews with 16 graduating seniors at the same institution. The purpose of the interviews was to gain a deeper understanding of the ways that students perceive digital literacy and its impact on their academic and professional careers. The development of the interview protocol and subsequent analysis was guided by the four research questions, all of which will be addressed in this phase of the study: (1) In what ways do personal background characteristics and early access to technology influence the development of digital literacy among college students? (2) What experiences and interactions during college influence the development of digital literacy among students? (3) In what ways does digital literacy influence college students' academic choices and professional career planning? (4) What are the main sources of information that students use to gather information about the technology demands of specific professional careers?

As with the survey data, I was particularly interested in the experiences of lower income students and therefore asked students to provide information about their family income in the screening questionnaire. In this chapter, I share data from the interview participants allowing their own words to tell the story of their experiences. Throughout the discussion, I provide a more detailed profile of 11 of the 16 interview participants whose stories capture the major themes that emerged from the data, although the narrative includes data from all of the students. All names are pseudonyms and any identifying information was omitted to protect the anonymity of the participants. I will begin by providing some general information about all of the participants and then consider how their collective experiences address the four guiding research questions. The findings are presented in three sections, including students' early experiences

with ICT, social networks and online engagement, and preparation and expectations for the transition to life after college. I will conclude the chapter with a discussion of the findings in the context of the theoretical frameworks guiding the study.

Characteristics of the Interview Participants

The 16 students I interviewed for this study were all getting ready to graduate when I spoke with them in May and June of 2016. The vast majority looked back fondly on their time at WU and felt that their college experience had been very positive. As one student put it, “I think I’ll always wish I have more time but it’s been overall really such a wonderful experience. I cannot imagine having been anywhere else because I feel like [WU] has such a phenomenal variety of resources that allow you to do whatever it is you want to do.” While some students were more pragmatic in their general synopsis of their college days, all of the students were pleased to have attended college and were making preparation for their next steps after graduation.

The interview participants were graduating with a wide range of academic majors from music to biochemistry to statistics (Table 5.1). Six of the 16 students were first-generation college students and 12 were women. As noted in the methods chapter, more than 50 students responded to the screening questionnaire that invited respondents to participate in an individual interview for this study. The questionnaire included 18 statements designed to measure the 13 components of digital competence outlined by Martin’s (2008) framework: statement, identification, accession, evaluation, interpretation, organization, integration, analysis, synthesis, creation, communication, dissemination, and reflection (see Appendix A). Students were asked to rate their level of proficiency in each area relative to their peers on campus, with a nine-point

scale that provided a text description for only the lowest and highest points: 1= “minimal skills and knowledge” and 9 = “high levels of skill and confidence.” Individual responses ranged from one to nine, and mean scores ranged from 2.78 to 9.00. The average score for all respondents to the 18 items was 6.68 (SD=1.42).

Table 22

Characteristics of Interview Participants, Grouped by Family Income Level

	Digital competence mean score ¹	Academic major	Gender	First Generation College Student	Need-based Aid ²	Family income ³
1	4.17	History	F	Yes	Y	50-75
2	4.60	Applied Linguistics	F	No	Y	30-50
3	5.56	Spanish	F	Yes	Y	30-50
4	6.22	Linguistics	F	Yes	Y	50-75
5	6.39	Biochemistry	M	Yes	Y	30-50
6	7.33	Biology	F	No	Y	30-50
7	7.44	Philosophy	F	Yes	Y	<30
8	8.00	Statistics	M	No	Y	50-75
9	9.00	Philosophy	M	No	Y	30-50
10	4.61	Communication	F	No	N	>100
11	6.11	Psychology; Sociology	F	No	N	>100
12	7.67	Microbiology	F	No	Y	75-100
13	7.78	Psychology	F	No	N	75-100
14	8.11	English Literature	M	Yes	Y	75-100
15	8.50	Music	F	No	N	75-100
16	8.61	Psychology	F	No	Y	75-100

¹ Based on average of student responses to 18 statements about digital competence on screening questionnaire

² Self-reported eligibility for need-based financial aid on screening questionnaire

³ Self-reported annual family income on screening questionnaire; in thousands of U.S. dollars

As Table 5.1 illustrates, interview participants had varying levels of confidence with regard to their digital competence, with mean scores ranging from 4.17 to 9.00 and an average of

6.88 (SD=1.54) across participants. Lower-income students, those with self-reported family income at or below \$75,000 annually, had mean scores ranging from 4.17 to 9.00 and an average of 6.57 (SD=1.66) across the group, while higher income students had mean scores ranging from 4.61 to 8.61 and an average of 7.27 (SD=1.41). Overall, lower-income students were only slightly less confident in their digital competence than their higher-income peers, and the interview participants reported similar levels of digital competence as the larger group of questionnaire respondents. While these small groups of students do not represent the larger student population at WU, their responses do reflect the complexities of examining digital competence and the fact that there is no simple explanation for differences in students' confidence related to information and communication technologies (ICT). In the following sections, I will share the stories of participants and present the major themes that emerged from analysis of the interview data.

Early Tech Usage of “Digital Natives”

David (participant #8) graduated from WU with a degree in statistics and had already lined up a job at a top consulting firm during the fall of his senior year. He was born in South Korea but moved with his family to the United States when he was in elementary school. Thinking back on his early tech use, David said, “I think my first time on the computer was when I was in second or third grade... I was just copying and typing.” His mother would practice English with him on the family computer when he was young, and she told him that having computer skills would be useful when he was older. In middle school, David was into gaming with his friends and also learned basic HTML coding at school but by high school he was more

focused on completing school projects. When asked where he gained these types of skills, David said, “I just sort of learned on my own... I just Google everything, it’s pretty self-explanatory.”

David’s early access to computers and ICT was similar to many of the students I interviewed. All of the participants had access to a computer at home at some point before college, although a few commented that they didn’t really use their family computer for various reasons. As one student commented, the internet was “so slow that I just would rather read or watch TV or something else.” Nearly all of the students talked about learning to type and play simple games when they were young. While there was a sense that some students had more and better access to newer devices and high-speed internet, everyone had at least basic access and was using the computer at a relatively young age. This is not surprising given the fact that these students were all born in the mid-1990s and grew up in a time when computers were more accessible and had become quite prevalent in American homes.

Lighting a Spark

It was clear from speaking with David that he was quite comfortable using the computer and was confident that he could learn new skills when he needed them for specific projects or interests. A common characteristic among the lower-income students, like David, who exhibited this type of digital literacy was some kind of personal influence that sparked their interest in computers and ICT or encouraged them to gain these skills as a step toward their future. Three of the four lower-income students whose digital competence score was higher than the mean for the group talked specifically about a parent who encouraged them to learn about computers and ICT from a young age. Conversely, the four students with a digital competence score below 6.0 each commented that their parents were not particularly comfortable with computers and similar technologies and that they had either learned these skills on their own or had cousins or peers

who played a significant role in their early exposure to computers. David talked about his mother using the computer with him to learn English and telling him that learning these skills would be important as he got older. In addition, his peer group was actively engaged in video gaming culture throughout middle school.

Jessica (participant #4) is a linguistics major who wants to pursue a career as a forensic linguist. She had been awarded a grant to spend the following year conducting research overseas. This was, in many ways, a strategic choice because she pointed out that, “A lot of the positions I’m looking at and applying for require 3-5 years having worked abroad.” Jessica said that one of her early memories was a picture her mom had posted on the kindergarten show-and-tell board. “I distinctly remember... my mom had a picture of me sitting at the computer trying to fix some problem.” Her mom had a home office and she remembered, “I would fool around on her computer growing up, playing games and things like that.” Similar to David, Jessica was interested in gaming with her friends and also gained computing skills in school: “I went to a private elementary school from kindergarten to second grade and even in kindergarten we had a computer literacy section.” Jessica reported that she had learned much of her digital competencies on her own, stating, “Honestly, I would probably say I was more self-taught.”

Both David and Jessica were able to tinker and experiment on the computer from a very young age, and each had parents who valued digital competence and encouraged them to develop these skills. They were also part of peer groups who were engaged in gaming. Nine of the 16 interview participants mentioned that they played computer games when they were younger, and for many it was among their first interactions with the computer. According to a report from the Pew Research Center (Duggan, 2015), two-thirds of young adults aged 18 to 29 say they play video games and 22% consider themselves gamers. Most of the students in this study who played

video games as youth were no longer heavily involved in gaming or gamer culture during college, although the student who rated himself highest in digital competence among the participants was still regularly involved in online gaming during college and described his sporadic play as “binge gaming” where he would go through spurts of playing more than six hours a day and then disengage for weeks at a time. He enjoyed gaming to “communicate and hang out with friends,” as a “time to unwind,” and an outlet for healthy competition. These interests are in line with research indicating that online games “have an unusually expansive appeal and serve a surprising number of emotional, social, and intellectual needs” for young people including the joy of competition, challenge and mastery, social interaction and opportunities to lead, and experimentation with different identities (Olson, 2010, p. 185).

Milena (participant #7) started using the computer with her mother when she was three or four, although she says she initially had more of a kid’s play computer that she used for learning letters and typing, and to play educational games. Milena said that her mom “didn’t really know English that well... she thought it was important for me to [use the computer to] learn English. She didn’t let me use the computer as much as she wanted me to learn on it.” As she got older, Milena’s family had a desktop computer that was “really slow” but she used it anyway to play games, communicate with her friends on Instant Messenger, and complete school assignments. Milena graduated from WU with a degree in philosophy and a minor in disability studies, and she wants to pursue a career in social work.

For each of these students – David, Jessica, and Milena – the computer was something that they were comfortable using for basic tasks from a very young age, even though their families may not have had ample resources to purchase the latest devices. These students, and all of their peers in this study, were using the computer to learn how to type, play games, and

communicate with their friends. David and Milena both had a parent who was an immigrant to the United States and who saw the computer and ICT as a tool to support their child in learning English and preparing for school and career. Of the 16 interview participants, 12 reported that their primary language spoken at home was one other than English. Researchers have sought to investigate the use of technology-supported pedagogies to support English language learners in school, with some studies showing positive results in supporting language acquisition (e.g. Lopez, 2010; Warschauer & Park, 2012) and reducing the achievement gap (e.g., Freeman, 2012; Kim & Chang, 2010). None of the students in this study specifically talked about receiving support or using computers at school to learn English, but it was something that several of them mentioned was important to their parents and may have helped get them ready for school.

Tech in School

All of the interview participants I spoke with remembered using computers at their school, but there was variability in the kinds of opportunities they had to use technology to support their learning. Janet (participant #6) is a biology major who wants to pursue a career in hospital administration. She started using the computer when she was four years old saying,

I remember this because my dad wanted me to learn how to type and he had gotten Windows 98, and we had a really big old computer... I just remember my dad made me sit there and learn how to type and other stuff, and that it would help me in the future. He projected that technology would become heavily integrated with careers in the future so he made me learn how to use it.

Looking back, Janet thought that this was probably beneficial even though she felt like her dad was pretty strict in monitoring her computer use when she was young. She now felt confident

that she could learn new programs and anticipated that she would “learn a lot of new things in the future.” While Janet’s father was eager to have his daughter use the computer at an early age, Janet shared that her father actually struggled quite a bit with the computing demands of his own career. She said,

I think the hardest part [for him] is working with young people who are coming out [of school] knowing how to use a bunch of technology... it’s sad to see my dad struggle. He becomes very frustrated and his work output is not efficient enough for his supervisor while others are doing so much more than he does. It’s very sad to see.

Janet joined the Gifted and Talented Education (GATE) program at her school when she was eight years old, and remembers that computers and other technology were an integral part of her experience in the program. “I fell in love with PowerPoint... I became a PowerPoint professional so starting at 12 years old I actually started assisting in teaching a computer course at my middle school,” she said. Janet felt confident using a range of programs including Excel and Photoshop, and was also very interested in social media applications such as Instant Messenger and MySpace.

Janet’s experience with ICT at her school was more robust than many of the other participants in the study, and even she was not engaged in advanced media-making projects or computer programming. All of the students mentioned using computers and online resources during school for things like typing up assignments and essays. Quite a few also talked about their school having a computer lab that they used regularly for educational games and quizzes, and to work on research projects. Half of the students were learning more advanced digital skills such as graphing mathematical equations or creating images and layouts with design software including Photoshop and Illustrator.

Three of the students mentioned having taken a computer programming course in middle or high school, and three more had used HTML for website design. David had learned HTML in elementary school, while Jessica had learned basic coding skills in a multimedia and animation course in seventh and eighth grade. She said, “The class was fun, it was an elective so you had all of your friends in the class... the videos we made were cool. I learned how to use a Mac for the first time, stuff like that.” Both Jessica and David had gone on to take computer science courses in college and were using these skills to support their professional pursuits.

Olivia (participant #13) took a class in high school where she learned some basic coding. She said, “I do remember my first and basically only experience with coding was in ninth grade. We programmed with a very easy, user-friendly program that I don’t remember the name of, but we used it to program little robots to do things. I enjoyed that.” Thinking back on the experience, Olivia added,

I do wish [our teachers], especially in high school, would have shown us more about computer programming. It was such an up-and-coming career. I was never – other than that one ninth grade class – I was never exposed to it and so when it came time to choose my major I did not even consider computer programming just because it was not part of the curriculum in high school at all. I wish that it had been because I think that I actually would have enjoyed it and maybe would have been good at it.

Olivia, who comes from a higher-income family and had a digital competence score above average for the group, majored in psychology in college. Olivia’s father worked in information technology (IT) when she was growing up so she had access to computers from a young age. She noted, “I have always kind of been inclined to be good [with computers and ICT] just because I was exposed to it at a very young age but I don’t know I guess you could [say I gained my skills

from] probably half schooling, half home environment.” She plans to pursue a career in human resources after college.

Ashley (participant #10) was another student who had taken a computer programming class in school. She took the course in ninth grade and commented that, “it was too hard” and “I don’t even remember much.” Ashley was not particularly interested in computing and ICT even though she had numerous opportunities to learn digital skills in school. “I think I remember in second grade we had a computer class to learn how to type but my friends we didn’t really talk about computers. We would just play outside more,” said Ashley. This sentiment did not change much as she got older: “I wasn’t into media in high school.” Yet, Ashley was graduating with a degree in communications and was planning to take a temporary job at the TV station where she had been an intern during her senior year. She was hoping to parlay this into a full-time position. Although she had a computer at home growing up, Ashley said her parents were of the “older generation who don’t really know how to use computers” and that she really only used the computer for writing essays and online research.

Computers were a fixture in all of the participants’ educational experiences by middle and high school, with some using them in elementary school as well. Yet, very few students shared stories of using technology to support their learning in any meaningful way or having learned something exciting that connected to their personal interests or professional aspirations. As previously stated, most students were using the computer to type up assignment and do cursory searches for online information. They were generally not engaged in more advanced projects where technology was being used to facilitate things like media-making, design, coding, statistics, historical analysis, life and physical sciences, visualizations, or language acquisition. Even among those students who did use technology in more interactive and engaging ways, very

few reported any kind of connection to the material or long-term impact. The following comments represent the sentiments of nearly all of the students:

- It was pretty much just typing up papers at that point because I think our teachers hadn't gotten used to the use of computers yet and didn't really know how to ask us for things with computers.
- If we used the computer [in class] it was more to learn to use the computer than it was to learn actual concepts.
- I went to a math and science middle school magnet so I had this computer class there and we would make PowerPoint presentation and then it was mostly exercises just to try the different tools. It wasn't necessarily to present on anything specific. It wasn't like 'let's do a history project on California – make a PowerPoint.' It was more just like, 'Let's tell a story of what happened yesterday morning – make a PowerPoint' ... We definitely had more time in the class to fill than things to do, and I think part of it was because it was like a subject in a vacuum instead of it being integrated [into the curriculum].
- I was part of [a large urban school district] so if [innovative or advanced digital skills and courses] were offered it was only offered for a small group of people.

Students' early experience with technology at home and in school did generally correlate with their digital competence score, indicating that early access and usage may impact subsequent confidence related to digital literacy. There was no clear distinction in students' access to computers at school and their level of engagement based on their family income though. Students across the income spectrum reported varying levels of engagement with educational technologies in school. At the same time, the lower-income students who also had a digital competence score below average were more likely to have slower and older devices at

home coupled with limited opportunities to use technology in meaningful ways to support their learning at school. As one student commented, “We didn’t have computer classes or things like that when I was in school. I know my cousins got to do that but I didn’t. So it wasn’t until college that I took a typing class.” This student speculated that this may have been in part because of where she lived, saying, “I lived in a more affluent neighborhood so a lot of students in my classes learned [coding and multimedia skills] at home, but I didn’t. I wish they would have offered that at school.” Conversely one of the higher income students who has taught basic computer programming courses and uses social media to support her work in music production commented that her school was still using “projectors and pens” most of the time but she was “lucky enough to have a family desktop when I was younger so even in elementary school I had already used the computer and at least was familiar with general computer navigation.”

Regardless of family income, students with the highest digital competence scores had a computer at home that they tinkered with to teach themselves various programs and skills, and to search for information. These opportunities seem to be an important component of gaining digital literacy, or the ability to use basic digital competencies to support one’s efforts in a specific arena such as academic or professional work (Gutwill, Hido & Sindorf, 2015; Vossoughi & Bevan, 2014). Another factor in students’ early interactions with computers and ICT was the influence of their peers.

Navigating Social Media and Professional Networks

Social interactions with peers are known to have a significant influence on young people’s identity development and socialization (e.g., Ryan, 2000; Wentzel, Russell & Baker, 2016), and it is therefore not surprising that many interview participants commented on the ways

that they used computers and ICT together with their friends when they were younger. Nearly all of the interview participants mentioned their peers when talking about their early use of computers and ICT. By college, students were using a variety of online communication tools to collaborate with classmates, connect with friends, and build their professional networks.

Tech with Friends

Fourteen of the interview participants directly mentioned their peers when they talked about the ways that they were using computers and communication technologies at an early age. For most, this meant chatting with their friends on Instant Messenger, texting, and creating a personal profile on MySpace or Facebook. A number of participants were involved in online communication as early as elementary school, while only two students mentioned that their parents limited their social media presence or computer usage until they were older. As one student put it,

My earliest memory would be MySpace, back when that was a thing. And then after that a lot of friends were use things like AIM [Instant Messenger]... I definitely just chatted on there day and night with friends. Pretty much just that. That's how I learned how to type really fast. Then after that I started to use the computer for school work starting in I think high school.

Students seemed to be doing “what everyone else was doing” as they navigated these new programs and learned to communicate online. This aligns with Sims’s (2014) assertion that young people gain specialized tech skills in communities of practice with their peers. In a sense, students characterized this socialization as relatively effortless. No one talked about any struggles with learning the programs or challenges associated with social media such as bullying or fostering competition and insecurities beyond one comment from Olivia, whose father worked

in IT, that her parents wouldn't let her create any personal accounts on social media because "it was kind of fishy back then."

In addition to social media and direct messaging, about half of the students were involved in online games with their friends. Jessica commented, "I would play solo games at the same time as my friends. We would have a few desktop [computers] next to each other and play the same games but not in each other's virtual reality." Similarly, David said that in elementary school he and his friends were involved in "Gaming, a lot of gaming." Another student mentioned that she "started using the computer through my friends at church, because they started playing games online."

Ava, a higher-income student with a high digital competence score (participant #16), was active with Club Penguin, a "massively multiplayer online game" that at its peak boasted more than 200 million users (Perez, 2017). She called it a "silly game... like social networking type of platform but for little kids." Ava played this game with her friends when she was in middle school. Club Penguin, which was designed specifically for six to 14 year olds, generated revenue through paid memberships and was purchased by The Walt Disney Company in 2007 in a deal that valued the company at \$700 million. Ava is a psychology major who was heavily involved in a clinical research lab during her junior and senior year at WU. She remembered using computers throughout her school years, and in particular as editor of her high school newspaper. Ava explained that, "I kind of taught myself because I was in the journalism class and I wanted to be the editor-in-chief so I was like, I have to learn all of these skills, so in the down time during classes I would just teach myself.... editing, graphic design." She planned to take on a full-time research position after college and then pursue graduate school and a career as a psychologist working with kids in a private practice.

Online gaming was obviously a popular activity among young people when the study participants were school aged, and for many it served the dual role of providing peer interactions and entertainment. As students transitioned to more academic activities in middle and high school, their online engagement with friends seemed to remain mostly social. As the previous section highlighted, students were not engaged in many technology-supported collaborative learning activities and they did not specifically mention working with their peers on school projects or using online collaboration tools such as Google Classroom or Moodle.

Shifting Social Media Practices in College

As students entered college, they remained active on social media and consumed other online content. As Ava put it, “I kind of have an account on everything. I have a Facebook, Twitter, Instagram, Snapchat, Tumblr. I don’t even know what else; if you name it I probably have it but I don’t use them too often anymore.” This was a sentiment shared by many students who said they had social media accounts but that they didn’t necessarily use them regularly to share their personal ideas or activities. A number of students used Facebook’s group chat feature or other applications like GroupMe to coordinate with friends on campus or stay abreast of activities in their clubs and organizations. “Yeah, it’s like if anyone wants lunch we will just send a group text saying like ‘who wants lunch’ and then some people will respond,” commented one student, while another said,

I think that if I wasn’t in all these clubs I probably would have my Facebook deactivated or more like all of my social media because I think that if I didn’t have to use it for my clubs and stuff then I wouldn’t really use it, but because... I have to be on there I just get distracted. A lot of clubs that I am in use group chats or group pages where everyone will

have a discussion about stuff... or [we are] posting events for those clubs and surveys and just all that stuff.

This was not the only student to comment on the ways that social media was distracting. Ashley, who hadn't been particularly interested in computers and ICT when she was younger, chose to delete a number of her social media accounts in college, stating, "I used to have Snapchat and other stuff like that but I got rid of them because I felt like they were distracting me... I got rid of the Facebook app [on my phone] too." Jessica also joked, "I watch way more Netflix than I would like to admit, most definitely."

Irene, an applied linguistics major who had secured a job with a major airline before graduation, commented that she had recently removed many personal photos from her social media accounts (Participant #2). "I used to not care but recently it just hit me hard, I don't know why. I took down a lot of my personal photos. They weren't even inappropriate, it was just selfies but... I looked really conceited," she said. Irene elaborated on her decision saying, "My friends really influenced me" by saying things like: "you're always posting your selfies – keep it to yourself." Despite these remarks, Irene confirmed that all of her friends used their social media accounts regularly as well. Irene was born in South Korea and had moved with her family to the United States when she was in elementary school. She had started using computers with her "older cousins" and "friends at church" all of whom were into online gaming. Irene noted that she was, "watching over their shoulders when my friends were doing it. I'm not really a game person," but she had become active on social media and used Facebook for group chat and reading news.

The only student who did not have any social media presence was Amir (Participant #5), who was a bit of an outlier from the rest of his peers. Amir didn't start using a computer until

middle school. “My parents generally used the computer at their workplace, and nobody in my family was using the computer much when they were at home,” he said. Yet, Amir’s school “had a computer instructor specialized in teaching us computers, like how to use Microsoft.” Amir also started using MATLAB, a numeric computing program, in his high school chemistry courses, a skill that would come in handy as he completed a degree in biochemistry and decided to pursue a research career in the biotechnology industry.

Amir had never owned a mobile phone and had “never had a social media account” except for a LinkedIn profile he created for a class and had never really used since. When asked why this is the case, he said, “I just don’t care much for it. I mean, yeah, I guess it’s not like a philosophy, I just don’t care to use computers when I don’t need to.” Amir admitted that people regularly asked him about his lack of social media presence. “I say that I feel like I’ve never needed one,” he said. At the same time, Amir was using advanced computer programs to support his coursework and lab research activities in biochemistry, he felt confident navigating search engines for academic resources, and he read news online.

News and Information on Social Media

Despite what students said about trying to limit their use of Facebook, Twitter and Snapchat during college, many students were using social media to get news and information. Seven students reported that Facebook was their main source for information about current events, while six said they used another news aggregator like Apple News, Yahoo News, or Reddit. Five students made comments about just soaking up whatever articles and sources were coming along on their Facebook feed. “My purpose for going on Facebook is not about news but eventually the news feed will post a lot of trends, ongoing events, people share stuff,” stated Irene. Similarly, Jessica said she gets her news “predominantly from Facebook I would say, just

from scrolling.” Ashley pointed out that sometimes it was just easier and faster to get news from Facebook if she didn’t have time to go in and actually read through a number of articles.

A few students were more intentional with their news feed on social media. Ava said that she got most of her news from Twitter, stating, “I follow a lot of online news sources so they’ll usually just tweet... a headline and link to an article.” David said, “I read a lot on Apple News. There’s an app called News that’s live so I read like Google News, New York Times, Wall Street Journal, stuff like that.” For Maria, a history major with plans to pursue a career in urban planning, Facebook was an efficient source of information (Participant #1). She said,

I follow some of my own websites [on Facebook] but it seems like Facebook is just on top of it... I feel like Facebook will alert you to certain things faster than like the television will. I think it’s more my community will post articles that will be linked to [a specific newspaper] and you just randomly select one from someone else’s profile.

Maria had gone to a school that had computers – she remembered her school getting “the Mac computers that had the colors in the back” – but they were only learning the basics, which she figured was because “in high school its mostly you still use a note book and a pencil... in public school a lot of students might not even have [a computer] at home so the curriculum is not based around things they are not going to be able to use at home anyway.”

As she transitioned to college, Maria felt comfortable with her basic abilities stating, “I am a history major so you don’t really need much, you know. You have books, you can write [assignments] on paper or exams would be in paper.” Maria seemed to take a similar view with social media and her online presence when she equated Facebook to an adequate news source where she understood the limitations but wasn’t particularly concerned about it. Another student offered a similar sentiment saying, “I don’t have time myself to read news every single day.

There are certain pages that you can follow on social media, for example like CNN. I have the app on my phone, so if something major happens CNN will send me the update on my phone, telling me like this just happened, something about politics, something about world news, something important.” These students were not alone in feeling overwhelmed by the pace of news and information as many participants commented on the challenges of staying up-to-date.

Among the 12 students who talked about the extent to which they felt well-informed of current events, no one was overly confident. For some it was simply a matter of time. “No, I work full time so I unfortunately don’t really have time to make it a priority. I hopefully will when I graduate though,” commented Jessica. For others, it was the sheer volume and pace of news. Janet stated, “There is so much going on... I mean I don’t even know what is happening in Syria and that’s been going on forever and in terms of world news I feel very left out and also politics – I am not very interested in politics so I find that very dry and boring.” Additionally, several students connected their lack of fluency with current events directly to social media. Ashley posited that,

I just get news updates but you know I definitely miss a lot of the other stuff that is newsworthy but social media might tend to favor one type of news.... even though I get news from Facebook and I think its viable, at the same time I kind of feel like, ‘Oh I get news from my Facebook. That is not like a good answer’... I think I see that it is inferior. Oliva was not particularly confident in her knowledge of news and events either and commented on the lack of credibility in her newsfeed, stating, “I think for the past year my Facebook has been blowing up with politics, but again this is not always, you know, a true source of news so I guess I am exposed to a lot of news just not like factual relevant true news.” Yet, despite feeling somewhat out of touch and even recognizing the limitations of their main sources of information,

the students did not seem overly concerned. Collectively, there was a sense that staying abreast of news was a significant challenge and not something they were willing to tackle when they were juggling school, work, and social commitments.

Adding another level of complexity to this discussion was the recognition among many students that their online experience was being tailored and curated by search engine optimization and algorithms that tracked their user behavior. This coupled with a social media network of many likeminded friends and acquaintances meant that gaining unbiased information online took more effort than many were willing to put forth. When prompted, nearly all of the students were aware, to some extent, that their user experiences on search engines, websites, and social media were being tailored to their preferences and search history. For most students, this became obvious when they searched for an item on Amazon or another shopping site and then subsequently saw advertisements for that same item on a new webpage. “I’ve noticed that on Facebook if I search graduation stuff like cap and gown or something then I’ll get ads on the sidebar for cap and gown options... but that’s all I have noticed. I just get very mad because I feel like they’re trying to sell me their products,” commented Milena.

Maria noticed the same thing, saying, “I’m not quite sure how they do it but... you know when you look on Amazon and then you go to your Yahoo mail and on the side[bar] is advertised exactly what you just saw.” She also noticed the way this impacted her social media accounts based on the geographic location of her network: “Most of the people I know are from... Southern California... if I moved and my network expanded towards the East Coast I would have more East Coast feeds.” Yet, Maria still felt like she was getting a broad perspective. She added, “I would say it’s kind of neutral because it also depends on other people’s interest and what they are going to post; what they like and what’s going to end up on my feed... I don’t

think it's necessarily bad. I don't think it's great either. It's just I've never really thought about it." Maria was not alone in accepting this phenomenon and moving on.

For Janet, when she first realized this was happening it "freaked [her] out a little" and she became more cautious about what she was posting and reading. "I am very aware that the things that are posted on the internet basically never get taken away, even if you delete it... I think that is maybe why I am so careful" With regard to information gathering she added, "I like to read both sides of the story so that I can make my own opinion rather than a biased story and solely believing that." In the end though, Janet said, "I am aware of [personalized search and filtering algorithms] and it does slightly concern me but I don't think there is anything I can do about it." During the U.S. Presidential election, Olivia noticed that she was being inundated with negative ads about one of the candidates. She reflected on this and realized that it was "probably just because I'm only exposed to one type of crowd, one type of opinion." Students had noticed differences in their search results and the most common themes on their social media feeds, as compared to their friends, based on their political leanings, sexual orientation, race and ethnicity, gender, and geography.

David was quick to point out, "Of course [I think about it], yes! I'm a statistician so I think about and I'm aware of the algorithms. I think it's a helpful tool." He felt like he could mediate the effects of the algorithms by "branch[ing] out to the sections or opinions I'm not too aware of – the things that Google is not suggesting." Ashley, a communications major, was the only student who had talked about these issues in her classes. She said, "[The algorithms] are so adherent toward finding out your preferences that it's showing you what you want to see and you will have a narrower sense of the outside world... I don't think it's healthy." Yet, Ashley was quick to point out, "I think it's pretty interesting but at the same time my personal experience has

been pretty diverse.” She gave several examples of Facebook friends from different parts of the United States or those with differing views than her own to support her assertion.

Students were cognizant of the challenges associated with the barrage of news and information that accompanied their digital lives, and some took steps to mediate their effects. Yet, in the end, no one was overly concerned about these issues and, to some extent, they all felt like it was a necessary trade-off for the convenience of the internet and social media. They enjoyed being able to find information quickly and easily without sifting through an endless web of URLs, and were using social media to connect with friends and organize their busy social lives on campus.

Building a Professional Network

Some students were being more strategic with their social media presence and were actively trying to develop a professional network to support their career aspirations. About half of the students specifically talked about creating profiles on the popular career networking site, LinkedIn, but many were unsure whether or not this activity would actually be fruitful. Maria commented that, “I have a LinkedIn [profile] but I don’t feel like I am using it the way I should... I haven’t really gotten deep into that type of networking... I am not sure exactly how to use it, I guess. I still filled out my profile but it’s not something I look at every day.” Milena said, “I have a LinkedIn [profile], which I’m connected to a couple of social workers. So, whenever they post stuff then I read it, but that’s all.” Ava felt like she was using LinkedIn “unsuccessfully” and added, “I created a profile but I haven’t really used it for any sort of professional purposes yet. It’s just sitting there.” At the same time, all but one of the participants has an active LinkedIn profile where I was able to gather information about their professional work after college.

Students were cognizant of the fact that potential employers may be gathering information about them online. Janet actively edited her social media accounts, and noted, "I feel like social media is such a big part of today that, you know, if I apply for a job I have a feeling that they are going to do a background check online so I just don't want inappropriate things on my Facebook... I try to filter those things out because I wouldn't want my future boss going on and seeing something inappropriate on my Facebook and then associating it with me even though it wasn't me who posted it."

Yet, even though Janet was trying to curate her online presence to some extent, she wasn't necessarily using social media to cultivate career connections, adding, "that's what I mean by professional use. I'm not so much trying to create a professional network or something like that." Other students made similar comments about keeping "your brand clean" and presenting a professional image: "even my profile picture is something that I took in a studio."

A few students had been more successful in creating a professional network to support their career aspirations and interests. David, who had been hired by a top consulting firm before graduation, had used LinkedIn and other online information to connect with potential employers and prepare for his interviews. He said,

There were a lot of companies who were job hosting on LinkedIn and... I could actually exchange messages with the people who were in charge of a position. I could also take a look at their LinkedIn profiles and get information about their backgrounds, like what school they went to, what activities they had done before they got their job so I was really comfortable before I talked to the HR people and before I conducted the interview. I felt it was a smart thing and a lot of people told me it was a smart thing to do. You know, when I get ready for an interview I've got to know someone, know their background, that

way I can continue the conversation and we're not just talking about my skills, we can go deeper and I can create a more intimate connection.

This approach had worked well for David and he talked about the kind of coaching he received from various mentors to prepare for his job search and interviews. "I went to the Career Center a lot of times and I was also part of a [fellowship program run by the university]. It was a scholarship program where the school connected me with a mentor so that I could get some practical knowledge about how to get a job or how to write prospecting letters, a cover letter, how to use the LinkedIn profile, how to connect with people on social media, how to Google people in the industry, stuff like that." The fellowship program David talked about was designed to connect top employers with talented undergraduates interested in various career fields, and helped students secure an internship and mentorship from university alumni.

David had developed significant career capital through his experience in this fellowship program. As previously stated, the concept of career capital is comprised on the three interdependent competencies of "knowing-why, knowing-how, and knowing-whom" (Arthur et al., 1999; DeFillipp & Arthur, 1994). David's various experiences in college had solidified his desire to pursue a career where he could utilize his advanced skills in statistics and data analytics (knowing why). He had gained advanced technical and professional skills through his coursework and various internship and volunteer experiences (knowing how). For David, the fellowship capitalized on these competencies and provided opportunities for him to learn useful strategies for developing a professional network and knowledge about the hiring process in his desired field (knowing whom).

Carlos was another student who was strategically using social media to further his career goals (Participant #14), but his path through college was somewhat different than most of the

other students. Carlos was an English Literature major who had been dismissed from the university two separate times. Due to various personal circumstances, he “felt like it wasn’t the right time for [him] to keep going” and had entered the workforce. He took on various roles related to theater production. After several years, Carlos utilized a university program to re-enroll and complete his degree with the encouragement of “several of [his] mentors in the field.” He added, “I told myself, I was finally on my own two feet and had grown emotionally in a way that I felt like, you know, at this time I think I could do it... I have a different kind of staying power.”

With regard to his professional career, Carlos noted that he had developed a strong professional network during his hiatus with the help of a college mentor. He said,

I became close with one of my professors; he became my mentor. He was sort of shepherding me through my career, giving me advice, helping me connect to people. More so in the beginning than now. Now I have a pretty established network but back then he was really introducing me to the right people who would take care of me and introduce me to other opportunities with them. I work in the arts, which is super project based, so it’s like rungs on the monkey bar... so making those connections with not only people who are practicing but also teaching you how to do it, that was a big part of it.

Carlos used social media, including Facebook and LinkedIn, to support his project-based career and noted that there was a lot of “overlap” between his personal and professional networks.

“Going from job to job, there are people that are professional contacts even though we're not working right now, but then we interact socially... so I am not posting party pics on my Facebook. I keep it pretty professional,” he commented. In addition, he noted that he was usually “networking for the next gig so I have to keep visible and stay on people’s minds.” As a project-

based professional who didn't rely on a particular company for his ongoing employment, Carlos had learned to use social media to support his work in a way that most other students had not. He attributed much of this career intuition to various mentors and his own drive to work in a field where one's reputation and experience is paramount.

Similar to David, Carlos had developed a high level of career capital through various academic and professional experiences. He had developed a keen awareness of the type of career he wanted after several years of working on theater productions (knowing why). When he came back to college, he embraced his coursework in a way he hadn't the first time around and gained expertise in academic writing, critical theories, and related technical skills (knowing how). He also maintained his professional network and expanded it through numerous internships and campus connections (knowing whom).

While Carlos and David are obviously both driven and charismatic individuals, their ability to develop a professional network and navigate social media had been aided to some extent by fortuitous events. Despite his academic challenges, Carlos had connected with a professor who supported his career even after he was dismissed from the university, and David had received a prestigious fellowship that was designed specifically to connect him with mentors and teach him the ropes of interviewing with competitive firms. In addition, Carlos was able to pursue short-term work assignments while he built up his resume and professional network that may not have been possible for other individuals with less flexibility based on family commitments or other financial responsibilities. Even if these types of resources were readily available on campus, which is a point of debate, college students must have the forethought to seek them out and figure out ways to connect these skills to their own career path.

Leaping into the Unknown: Preparations and Expectations

As students prepared to graduate and looked ahead to their professional careers, digital competence was only one component of an important array of skills and experiences that gave them the confidence to reach their goals. Some students were more confident than others as they neared graduation and their next steps began to take shape. With their college careers coming to an end, students reflected on their time on campus and considered those experiences that had helped to best prepare them for life after college. For seven students, the soft skills, such as effective communication, teamwork, and critical thinking, that they had gained through various academic and co-curricular experiences on campus were the most important in preparing them to take their next steps. Six of the students talked about discipline-specific academic and technical skills that they had gained, while four referred to the soft skills that they had acquired during a particular internship, research, or work experience. Basic digital competence, not surprisingly, was not a driving force in students' career decisions but these skills were often seen as a necessary baseline for success in any field.

Students' experiences in their academic courses and with their professors were an important component of the path to discovering their career goals. While few students identified a particular course or classroom discussion as the impetus for their career choices, students did gain valuable foundational knowledge and insight through these experiences. With regard to career-specific skills and competencies, students' ideas about the extent to which their courses should provide practical training and technical expertise were mixed. Similarly, students reported that most faculty and instructors in their undergraduate courses were not utilizing advanced instructional technologies to support their teaching but their feelings about the benefits of technology in the classroom were also mixed. The interview participants' experiences outside of

the classroom tended to more directly inform their career plans and offer more hands-on training and mentorship for discipline-specific technical skills.

Putting their Learning into Practice

Nearly all of the participants had been involved in undergraduate research or internships during their time in college. Eleven students completed at least one internship and nine were involved in guided undergraduate research experiences. Of these students, seven did both internships and research. Some students had internship and research experiences that were directly related to their professional goals while others used these opportunities to explore their interests and pick up valuable skills.

David, who had already lined up a consulting job before graduation, had several internships, including one in Washington D.C. as part of a fellowship program, and campus work experiences throughout college that were closely aligned with his career plans of working with data analytics. Of his internship, he commented,

I learned a lot of data analysis skills, how to analyze, how economics influence investments or equity at an institution ... so it was very practical in terms of theoretical and analytical skills I need for my career. I was able to apply the things that I've learned at [WU] to this, and use them to understand how that impacted the company.

As a statistics major, David was able to find internships that provided hands-on experience applying the technical skills he had honed in his classes.

Carlos, who worked in theater production, had completed four internships during college in addition to his many work experiences. He noted that his internships were “all within the field of the arts, they were just different parts of it. Administration and production versus philanthropy versus marketing.” He noted that although he wasn't going to pursue a career in marketing,

understanding the many diverse roles involved in putting together a theater production and developing a basic skillset for each would greatly enhance his ability to take on leadership roles and pursue a career in theater management.

Jessica wanted to pursue a career in forensic linguistics. She had started college as a psychology major but had switched to linguistics after completing an internship as a crisis intervention counselor. Jessica said, “It was a really good experience and I learned a lot, but it also made me decide I didn’t want to be a psychology major.” She said that she worked closely with law enforcement during that experience and it had opened her eyes to a potential career in law. Jessica then took a course focused on linguistics and eventually became interested in forensic linguistics. She also worked in a research lab related to linguistics where she gained hands-on experience and advanced her technical skills. “It has opened a lot of opportunities for me because I worked in the lab for so long and I’ve taken classes with the professor who runs my lab, so I know him as a professor, as a researcher, and as a friend. It’s really been a great experience,” she added. Jessica pointed out that the research being done in her lab was unrelated in many ways to her career goals, but she still felt that the overall experience had helped her solidify her interests and prepared her for the research she would be doing overseas after graduation.

Research experiences were an important opportunity for many students to refine their career goals. Specifically, a number of students, including Jessica and Ava, had decided that they did not want to pursue a career in academia or research after the experience. Ava had worked in the same clinical research lab throughout her time at WU. She received extensive training when she joined the lab. “There’s a great deal of training... The equipment is really expensive. They don’t let you teach yourself, they train you. So I got maybe six hours of training over the course

of two days in order to be able to use everything,” she recalled. According to Ava, all of their work in the lab “happens on computers” and she had gained a wide range of technical skills.

Additionally, she said,

I’m much more patient with technology too because our programs are really old and our computers are really old so they tend to have a lot of problems and no one is usually around to help me fix them so I’ve had to sort of learn to troubleshoot on my own and I think those are pretty valuable skills.

She clarified that, “It’s not that the stuff we’re using is outdated, it’s just that it runs very very slowly.” For Ava, these experiences were essential in preparing her for the demands of a Ph.D. program, which she planned to pursue on her path to being a psychologist in private practice.

Amir had also worked in the same research lab for several years and felt that it was a “very, very good” experience. He had developed important skills including, “The ability to think well, to come with solutions on your own, using these specialty software, I guess you learn the tools of research.” Amir wanted to pursue a research career in the biotechnology industry and felt that he would “have better work opportunities if [he had] a Ph.D.” Gaining hands-on experience was essential for his career and admission to graduate school. “Technical skills, of course, are more important than anything. The technical skills are what’s really valuable,” said Amir. For each of these students, the opportunity to put their learning into practice and gain practical knowledge about a specific field was an important step to solidifying their post-graduate plans. Additionally, the guidance they received from supervisors, faculty, and peers proved to be pivotal component of the decision-making process.

Gaining Work Experience and Paying the Bills

In addition to research and internships, many students worked part- or full-time during college. While some students found paid professional opportunities related to their career goals, others were focused on supporting themselves during college and simply found a job to help pay the bills. Among lower-income students (participants one through nine), all but one were working on- or off-campus. Three of the higher-income students were working, but among them one was working in his field, one was leveraging social media to find projects related to her interest in music production, and one was working on campus for a student publication.

The lower-income students had a wide range of jobs during college, and many had cobbled together several positions. Jessica said, “I work a couple of different jobs, so I work four jobs and I work like 10-15 hours at each.” Three of her paid positions were on campus and then she worked at a sporting goods store on the weekends. Melina had worked as a home health aid and she also worked in retail. Irene worked part-time as a language tutor for young children, and David was working 20 hours a week at three different offices on campus. Some students viewed their employment as a positive part of their college experience that provided them with useful skills, necessary financial support, and knowledge about the workforce. Melina commented that it was, “both positive and challenging...but I think it helped me more than it hurt me.” As Jessica put it,

I think there’s a tremendous value [in working during college.] I definitely would have worked even if I didn’t have to... I think the value is learning to be financially independent, even if you’re not completely independent... and it’s also good to work on your time management skills. If I didn’t work full-time, I’d probably watch even more

Netflix, which I really don't need to do, but I do need to be a little bit more productive with my time.

As previously stated, Jessica was also involved in research and had completed an internship in college but her goal was "to graduate without any debt" so she worked more than 40 hours a week, on average.

Janet was "financially independent" and therefore found various paid positions, in addition to her classes and research experiences, to support herself financially during college. She said she was not involved in any student organizations because it was "more important for me to find a job." Yet, she struggled a bit to manage her many responsibilities. She worked in the same lab for two years but said, "I actually quit my job...because my grades were falling and I wanted to improve them, so I quit that because it was very time-consuming." Janet had also struggled with her career plans because her parents had been the driving force in her original goal of applying to medical school. After much self-reflection and support from friends she decided to shift her career goals to public health and hospital administration. As she put it, "a lot of my friends encouraged me to kind of break through and just really let my dad know that the medical field was not for me. That is kind of why I made the decision; let's try to get the best of both worlds and have science and business."

Janet faced many challenges during this time, including personal struggles and pressures from her family. Her grades were suffering and she was struggling to figure out her academic major and career path. Janet visited her academic counselor when she started to worry about her student standing, and the counselor encouraged her to get some experience in the field of public health to feel it out and decide if this was worth challenging her parents' wishes. The counselor helped her find a volunteer opportunity at a hospital near campus. Janet helped run an outreach

program for veterans that encouraged them to change specific behaviors by sending them regular text messages with reminders and information. The program used “an encouraging text to tell them to [take a specific action] and it was an automated system so it’s not like a real person sitting behind there typing but the feedback that I got from the [participants] was actually, a lot of people thought I was the one texting them,” said Janet, adding,

After this program, that’s what made me decide that I want to do public health and health administration because it was just an emotional inspirational project for me. [The participants] say that I motivated them...but they motivated me, I guess, for the rest of my life so that was very great.

Looking back on the experience, Janet said,

I was so blessed to have those people in my life. It was a once-in-a-lifetime opportunity. And at that time, I was really debating – do I want to pick up a second [position] and this was volunteer. I was not getting paid for it so I am like, okay my grades are dropping and I was spending 12-20 hours a week in the research lab, on top of taking four science classes at the same time... I’m thinking, ‘Do I really want to pick up a volunteer position? It’s not going to really help me pay for anything... this a not good idea.’ But in the end, everything was so unstable at the time that I decided it was now or never. I just took it and I don’t regret it, and from then everything started going up for me so it was really a good decision.

Janet had to weigh many factors in making her decision to volunteer on this project related to her desired career goals. Fortunately, Janet’s decision proved fruitful as she gained new competencies and solidified her desire to focus her career on public health and administration.

As a transfer student, Maria had also struggled to find enough time to pursue her various interests. She noted,

It was very stressful...when I transferred here I only had two years to really get the ball moving and kind of settle into what I want to do post-graduation. I think in the long term it takes a toll on you because you have to take advantage of all the opportunities that are presented to you, if you can find them, if anybody informs you of them, and think about – do you want to go grad school? If you wanted to work, have you networked? Have you taken the time to get to know your professors so that they can give you letters of recommendation? All within those two years.

Maria, a history major, was very interested in a career in urban planning but she had only taken a few introductory courses in the department and had not been exposed to the more advanced technical skills associated with the profession. She noted,

I think it's kind of hard to step out of your path and try to get to your goals because either you are going to feel like, I can take the class that I really need or take a class that I will be interested in... you are kind of stuck between the two and then also you don't want to take a class where you might not do well... I am interested in GIS [geographic information system], of course, but I am also scared that what if I don't do well or if I don't grasp how to use the program well enough it's going to affect my GPA.

Mastering the technical programs associated with a career in urban planning felt like a challenging addition to her already packed schedule. In addition to feeling like her time on campus was limited, Maria also had a job and internship during college.

Maria said that during her first year at WU, she “took a year off from work” and lived in the dorms on campus. Looking back, she said, “it was nice; it was a little easier. I was in a setting

where everyone was studying, I was close to the library, and close to resources that I needed, when I need them. And I wasn't working so focusing on school was a lot easier." Maria's financial aid changed the next year and she was no longer able to afford to live on campus. She said, "I had to move back home. I'm not too far away, but it is a big difference." At that point, Maria also found a retail job but noted, "I work on the weekends and... it's really hard to find a job that can be flexible with your school schedule... it's actually really really hard to find one because most businesses are going to want you to be flexible for them and not the other way around." Reflecting on the experience, Maria recognized that juggling her school and work commitments was difficult but, she said,

You don't think about it at the moment because you are so focused on trying to get everything together and you know your week goes that much faster. I have to take the bus to and from school so Monday through Thursday I am going to school and I am also doing an internship two days a week and then on the weekends I have to work Friday, Saturday and Sunday... but, you know, I need the money.

Maria had obviously mastered the art of juggling many commitments during college, but there were signs that this routine had impacted her ability to explore her career interests and advance her field-specific skills.

Many of these students who had jobs unrelated to their academic interests pointed out the practical skills that they were gaining, such as people skills, leadership abilities, and digital competencies that could be used in any professional setting. At the same time, those students who did not have to find a paid position to help support themselves during college were able to focus more time on their coursework and academic interests as well as other pursuits such as unpaid research and internships opportunities and involvement in clubs and organizations on

campus. This flexibility likely gave higher-income students more time to participate in communities of practice related to their personal and career interests where they advanced their digital literacy and career capital. Although she was not getting paid for her work in the research lab, Ana was quick to say, “I don’t have time” for a job. As a higher-income student, she may have had more financial support from her parents and or was less concerned about accumulating student loan debt during college. Either way, she was able to focus all of her attention on her commitments in the research lab where she worked, which served her well when she applied for Ph.D. programs.

While the lower-income students may have had less flexibility with regard to employment, this did not stop most of them from filling their resumes with academic and pre-professional experiences. They had been involved in research, internships or both, and many were also active on campus with student organizations, volunteer work, and other commitments. WU is a top university and these were highly motivated students. Even if they had to hustle from place to place and develop strategies for improving their time management and study skills, the participants were determined to make it work and they were building important career capital that would support their transition to life after college.

Mentorship and Professional Networks

Students’ various academic and co-curricular experiences in college were instrumental in helping them define their career goals and build a toolbox of necessary skills and digital competencies. In addition, most students talked about individuals who had helped them in gathering information about their specific career field and provided support and encouragement. Some of these mentors also opened doors for the participants to connect with people, networks, and opportunities that helped to propel them forward along their career path.

Students' research experiences were an important source of mentorship and practical training in a specific community of practice. Six of the nine students involved in research specifically mentioned an individual who they talked to about their career plans. As the previous section noted, Jessica felt like she knew the principal investigator of her lab "as a professor, as a researcher, and as like a friend." She even noted that she wanted to pursue a career in academia until learning more about it from conversations with this professor. Amir felt that the faculty in the research lab where he worked were "excellent" and "very real," which he appreciated. For the other students, they found support from graduate students in the lab who were often the ones to train them on the technical aspects of their work and were also available to talk about more personal issues such as academics and career aspirations. Ava joked that she, "laid eyes on our [Principal Investigator] once" but that there was one graduate student, in particular, who she met with regularly and saw as a resource for talking about her career goals and interest in graduate school. "I feel like we're so close. I feel like I can just ask him anything and he would answer my email in seconds or whatever so I get a lot of information from him."

On a separate research-based internship that Ava completed, she again talked about the mentorship she received from graduate students on that project. She commented that, [The graduate students] were sort of mentoring us individually on independent projects they were working on. They were training us on how to code [the data]. They were training us on how to use specific functions in [the coding software] so we spend a lot of time together. And in addition to teaching us stuff in the internship, they also have a lot of graduate school talks on how to prepare for the GRE and things like that.

Through these various interactions and experiences, Ava noted that she had refined her desire to work as a therapist with young people: "I hadn't known what sort of populations I was

interested in working with until I did [my internship] and so I found my passion through it.”

Undergraduate research experiences, when executed well, are designed to provide students with an opportunity to interact with experts in the field and learn through hands-on training. This hands-on training, or legitimate peripheral participation, is an important way that academic departments encourage retention and try to spark students’ interest in pursuing a career in research (e.g., Eagan et al., 2013; Yaffe, Bender, & Sechrest, 2014).

Beyond the formal structure of research mentorship, students leveraged their networks and gathered information about their specific career field from a variety of sources. Some were more successful than others. As previously noted, David had gained very specific technical skills through his coursework and internships related to his goal of working in data analytics and consulting. He also talked about the fellowship program he participated in where he was partnered with a mentor and received guidance on how to gather information about employers and prepare for an interview. He noted that, “Even if I have a really high GPA, really great computer skills, without a network I knew that it would be really difficult for me to get a job at a good company.” David said that when he was looking for an internship, his supervisor at a job on campus had connected him with professionals working in the area. When he started interviewing, he communicated with the Human Resources departments ahead of time and researched employers’ background and interests so he could connect on a more personal level. Of the experience he said, “I’m sure that all the people they decided to interview know how to program stuff or how to code, all the students they interview are professionals in computers. I think the soft skills, communication skills, how to interact with people can set you apart.”

Olivia, who planned to pursue a career in human resources (HR), had completed several summer and short-term jobs and internships to inform her professional goals and gain relevant

skills. She felt like these experiences had “fully cemented my interest in HR and taught me a lot of skills that will help me in the future.” As she looked ahead to her job search after college, she said,

My dad has worked at a few different companies and...has made connections over the years. And I was fortunate enough for him to get me an opportunity to speak with a few people...who are currently in HR, who are probably 10, 20 or 30 years older than me who...just told me what the career is like, what they like about it, what they don't like about it, that kind of thing. I think that's pretty lucky that I've gotten the opportunity to speak with real world people in my career field and learn more about what the career field is.

From these conversations, Olivia learned more detailed information about the different positions and specializations within the field, and the kinds of skills and expertise that employers would be looking for in hiring new graduates. As she approached graduation and started thinking about looking for full-time work, Olivia noted, “I definitely try to keep in touch with the people that I have worked with and the contacts from my dad.” These contacts had proven the most valuable in gathering information. She recalled that the career fair she had recently attended was more focused on recruitment while her coursework in psychology had not been directly related to her career goals.

Olivia had taken advantage of her own personal network and family connections to gain experience and gather information about her career. Most students had much less guidance in learning about their field and what types of skills and expertise employers were seeking in new employees. Five students had mentioned the career center on campus, but of those two noted that they were never able to get an appointment to speak with a counselor. Six students talked about

doing research online to learn more about careers and employers, and they felt like this was an efficient and useful way to gather information. As Melina put it, “Yeah, I mean I can ask [people at my internship], but I’d rather just Google stuff. I feel like Google might know more.” Amir said that after gathering some information about careers in the biotech industry from his professors he had chosen which graduate schools to apply to based almost exclusively on the U.S. News and World Report rankings. “Some people would criticize me for that but, that’s what I did,” he said. One student planning to apply to medical school noted that the pre-med student organizations she was involved in had been a good resource along with a “semi-internship” she had with a physician whom she shadowed.

Ashley, a higher-income student who was majoring in communications, had an internship as a sales coordinator at a local TV station during her senior year. While this opportunity helped her to recognize that she may not want to pursue a career in sales, it had also opened her eyes to many other related positions at the station and she felt like she had a “long way to go” in narrowing down the kinds of positions and companies she was interested in. With regard to gathering information about her career field, Ashley noted, “I feel very limited because I don’t know where I should go,” even though she had visited the career center on campus and talked to people at her internship site. According to Ashley, when she asked for advice about finding a job her contacts would say things like, “Go look – there should be a lot of opportunities.”

In many ways, Ashley felt “overwhelmed” by the prospect of interviewing and finding a job after college. She was uncertain about what skills employers valued most, and commented, “I feel like being a recent graduate is not a great place to be in unless you have a lot of experience... I don’t know what to do and people are expecting me to apply

everywhere... 'Apply at YouTube, apply at Google, apply everywhere' but I was just like 'Oh my gosh, can I even apply to something like you? I just feel overwhelmed. Even though she had completed an internship and had worked on campus, Ashley was not sure that her college experience had prepared her to find a job. "Honestly I think it prepared me [as a person] but maybe not job-wise. I have been feeling like my skills are pretty replaceable, like expendable because it's not like technical skills like computer science or engineering." Of finding a job she added, "It's a little bit of your skills, of course, but it's also a little bit of luck and who you know."

Yet, with regard to developing a network of personal and professional contacts, Ashley was not confident in that regard either. She started out by saying, "I am happy with who I know" but then admitted that she wished she had connected with more professors. "I don't why I don't really see them as, you know, 'a go to.' I am not too close to them but at the same time I feel like if I need something there is someone I could maybe go to." She also reflected on her college experience saying that maybe she should have joined professional organizations, taken on leadership positions, gotten another internship, or studied more. In the end, though, she said,

I don't think I'll regret it because I think every step that I took actually taught me, not just to take responsibility, but really feeling and experiencing it for myself... it's overall taught me to become a person that could have different kinds of perspective and see things differently, to just be content with what you have... College is a very identity building experience I think more than professional or job stuff.

Despite these concerns, Ashley was confident that "everything [would] be fine" and even though she was concerned about finding a job she was not alone and had many friends in the same situation.

Although Ashley was probably the least able to articulate her career goals among the study participants, she was not alone in feeling like college was an important experience for developing one's sense of self and identity. Research indicates that many college students highlight their personal experiences and the interpersonal skills and perspective they develop as being the most important component of their college career (Arum & Roksa, 2011). In addition, Ashley was not the only student to struggle with translating specific college experiences into skills for their professional careers. Several students talked about technical skills they had gained in college that they did not feel would be relevant to their future career.

Olivia had gained skills in data analysis and statistics in different classes as part of her major in psychology, yet she didn't see how these skills would be valuable to her career in human resources. She noted that a professor had taught them how to use "this program called SPSS, which helps you to search and analyze data, but since am not going into [a career in psychology research] I don't really count that. I guess that would be an example of career skills if I was going into a career in psychology." Similarly, another student didn't feel like her training in data analysis would be useful to her future career in education and university administration. When asked whether she thought she would use these skills she said, "Potentially I could, I don't want to say that I won't but...I don't think it's anything I can use... I cannot really see myself in a field where I am looking at [information] in that way."

Janet, who was planning to pursue a career in hospital administration and public health, had learned a variety of data collection and analysis techniques as part of her position in a clinical research lab. Yet, she said, "I don't think that the things that I learned at the research lab would apply to my future career but it would definitely apply when I get into grad school." For these students, there was not direct connection between learning how to organize, analyze, and

present data and information using computer applications and the kinds of activities they would encounter at work. A few students also talked about their academic work being “more theoretical” than technical in nature, but they were not generally concerned about this fact and felt like they could gain any technical skills they needed at work.

Confident about their Next Steps

Overall, students looked back fondly on their experiences at WU and were optimistic about their transition to life after college, even if they felt uncertain about searching for a job and entering their chosen career field. Three of the students had already lined up jobs that they would start after graduation. David would begin his consulting position in the summer. Irene, an applied linguistics major, had taken a position with an international airline. During her four rounds of interviews, she had to completed numerous tasks online, including translating an article. “I had to read this article regarding airports... I had to translate the [text]. They told me to use dictionaries online if I didn’t know any word and I only had 20 minutes to complete the assignment. It was very intense.” In looking ahead to her new position, Irene said, “I feel like I’m really well prepared.” She also noted that she could see herself working for this company for many years and felt like that was a realistic possibility because she felt like the company valued her skills and wanted to hire employees for the long term.

Maria had been offered a full-time position by her internship supervisor for the following year, but it was not related to her career interest in urban planning. Even though this position was unrelated to her career goals, Maria felt like it would be smart to take the position. She hoped to look for paid or volunteer positions to gain experience in urban planning while she was working. She explained,

I will be looking at different jobs...while I am working just because I know it's really hard to...find positions, entry-level positions that are going to pay well enough where you don't have to take a second job or that aren't just volunteer position... especially if its non-profit organizations. They are not going to have a lot of opportunities for people to just come in and start working.

Even though Maria wasn't going to be working in a job directly related to her desired career field, she still felt like she could gain transferable skills while she looked for opportunities more directly related to her long-term goals.

Three more students were planning to take a position related to the internships or research positions they had in college. Ava would transition into a full-time research coordinator role in the same research lab as she prepared to apply for Ph.D. programs in clinical psychology. Ashley was hoping to transition into a permanent position at the television station where she was an intern during her senior year. Three students had also decided to go directly to graduate or professional school. Nine months after graduation, all but one of the students had an active LinkedIn profile that provided seemingly up-to-date information, and most of the students had transitioned into a professional role similar to what they described during their interviews.

Discussion

The qualitative findings highlight the ways that digital tools and online spaces are influencing college students' interactions, academic engagement, and career preparations. The findings confirm the assumption that a digital divide based solely on access to technology has been supplanted by a more complex relationship with information and communication technologies (ICT) as these tools become increasingly present in nearly all social interactions

and communities of practice. All of the students in this study had access to a computer at home and in school when they were young, and they were all comfortable managing basic tasks such as cursory searches for information, online communication, and using programs such as Word, Excel, and PowerPoint to support their academic work. Additionally, there was no clear distinction between lower- and higher-income students' self-ratings of digital competence. As Table 5.1 illustrates, students' digital competence mean scores ranged from 4.17 to 9.00, irrespective of reported family income.

Despite these commonalities, students' early experiences with computers and ICT did seem to influence their attitudes later in life. The participants were involved in various communities of practice related to digital competencies from an early age, including parental and family units, peer groups, and classroom environments. Students talked about learning specific skills by sitting on their parents' laps and tinkering with computers or peering over an older cousin's shoulder as she navigated social media or online games. This type of socialization felt automatic for the participants and not something they really thought about as influencing their social and academic practices. Yet, through these interactions, students were observing and establishing their own differentiating practices for using digital technologies (Sims, 2014). Few students were using specialized skills in school, although a few built a foundation for subsequent training. Most of the students who had learned some computer programming, HTML, design and layout skills, or mathematical graphing in school had gone on to advance these or related skills in college.

These findings align with Sims (2014) assertion that young people learn to match particular strategies and digital usage with desired outcomes. For example, Ava wanted to be the editor-in-chief of her school newspaper and therefore set about learning design programs such as

Photoshop and Illustrator that were used to create the publication. She had access to these programs through her journalism class, had a strong foundation for using the computer based on early exposure at home and in school, and she recognized the benefits of gaining these skills to reach her goal. Similarly, Amir had started using Matlab, a numeric computing program, in his high school chemistry courses. While he may not have recognized it at the time, Amir was gaining valuable skills that would give him a leg up when he entered his introductory science courses in college and started applying these skills at a more advanced level. His high school courses had introduced him to these specialized software applications and likely gave him a level of confidence that other students who had not used these programs would have to develop in college. Undergraduate introductory science courses are often seen as gatekeepers for students interested in pursuing careers in science and technology fields, with lower-income students being disproportionately steered away from these majors based on their early experiences (e.g., Chang et al., 2014; Gasiewski et al., 2012). Entering college with a basic understanding and familiarity with related mathematical computing programs could significantly influence a students' confidence and drive to persist in these competitive and often unwelcoming environments.

At the same time, a number of scholars have critiqued the ways that digital technologies are influencing cognitive development and individual engagement with specific tasks. In his popular book, *The Glass Cage*, Nicholas Carr (2014) critiques the risks of technology-supported automation in a wide range of activities from the mundane to the highly technical. He states, "Automation tends to turn us from actors into observers... That shift may make our lives easier, but it can also inhibit our ability to learn and to develop expertise (Carr, 2014, p. 72). Carr goes on to discuss "the generation effect," or the idea that going through the mental process of generating ideas or information will improve people's ability to carry out tasks and deepen their

understanding of concepts (p. 73). Automation can, in many ways, counteract this important mental work, even though it streamlines activities and simplifies the work of individuals.

Jessica, the linguistics major, alluded to this phenomenon when she talked about the ways that technology was changing young people's writing skills. When she reflected back on the use of technology to support instruction at her school, she commented, "I would actually kind of like to do less [with computers]. I think computers are a little too prevalent in the current day and age." She went on to say that when she was in school, "we had to write everything by hand and we had to spellcheck by hand and all those things and now it's like, oh type it into the document and push the spellcheck button." As a linguist, she recognized the importance of technology to support academic work but felt like young people should master certain skills without the help of computers. She noted that, "Microsoft Word was written by a linguist, and I think it's a really good thing to have but I also think that you should know how to write before you learn how to use the computer, which isn't really something that people learn anymore in that order."

Jessica was one of the few students to recognize the ways that technology might negatively influence learning and skill development. At the same time, most students were not significantly engaged in computing at a young age, and felt that their schools were only using digital devices as a tool to replace certain activities – everyone was learning to type and submit essays online, for example – and not to enhance their learning in meaningful ways such as media-making activities to encourage civic engagement or using computer simulations and visualizations to learn about the human body, historical events, or the solar system. As Carlos noted, even at a science and math magnet school his computer course was more about learning basic tools such as PowerPoint and not about using technology to enhance the curriculum or learn new content. He felt it was being taught "in a vacuum."

Martin's (2008) conceptual framework for digital literacy recognizes the importance of gaining these foundational skills such as how to find and organize resources, analyze information, and communicate and disseminate relevant output to others. Digital competence is a necessary baseline for developing digital literacy. The framework also recognizes the importance of social practices though in shaping people's attitudes and behaviors, and the need for individuals to apply these basic skills in specific communities of practice to accomplish tasks and goals. If students are only learning how to use PowerPoint to talk about what they did over the weekend, as Carlos suggested, and not how to share relevant information with peers in an academic course, then they have not really transitioned into the realm of digital literacy for that particular community of practice. Further, if students are only engaging with technology at the level of simplifying specific tasks in their lives and not as a tool to support inquiry and creativity, then this falls in line with Carr's concerns about automation and the generation effect. When computers and ICT are not introduced as tools to enhance learning and engagement these tools can end up serving a substitution role for basic tasks or even negatively impact the deeper learning that happens through active participation and concept generation.

Another social practice that was prevalent among all of the participants was their use of social media platforms such as Instant Messenger, Facebook, YouTube, Snapchat, and so on. All of the students were introduced to social media at a young age. Even Amir, the only student who had no social media accounts, was cognizant of his outlier status and had to be ready to explain his decision to disengage from this collective practice. The participants had all migrated from one popular application to the next as they gained and lost prominence and cache. These social practices may feel innocuous in an environment where everyone is using social media to post selfies and vacation photos and it doesn't directly influence a person's academic and professional

pursuits. At the same time, the findings point to the ways that students use social media as a main source of news and information with very little reflection on the limitations of the platform to deliver reliable resources, or multiple and challenging viewpoints.

The participants' social media practices were generally quite consistent. Most were consumers of information and were not regularly posting and sharing commentary or curating a particular online presence or persona. Some were more active than others in using various platforms to stay connected with friends and colleagues, and a few were using social media to support professional endeavors. All of the participants were gathering news and current events online, and half cited Facebook as the main source. Nearly as many were using another news aggregator such as Apple News to gather and filter resources. While students generally felt well-informed a number of them were also disengaged or overwhelmed by the pace and flow of information. This is not particularly surprising given the widespread recognition that American society has moved toward a 24-hour news cycle ushered in by the massive proliferation of online news sources, niche and special interest reporting, blogs and vlogs, clickbait, and YouTube celebrities. And while most of the participants did recognize the ways that Facebook might be limiting the kinds of news and current events they were seeing and reading, they were either too busy to worry about it or felt like they were able to counteract these negative effects by having a diversity of "friends" in their network or seeking out "both sides of the story" on topics of interest. Whether or not these remedies happened regularly in practice is likely an issue up for debate.

In addition, the participants seemed much more concerned about the perils of posting "party pics" from the previous weekend that employers or others might get their hands on than worrying about algorithms that were sorting and filtering the constant stream of information they

were searching and receiving. While the students generally recognized the fact that items they shopped for on Amazon may end up in advertisements on the sidebar of their email account or Facebook feed, some saw this as irritating – “they’re trying to sell me their products” – while others just felt like it was a necessity and added to the convenience of finding information online. After all, students’ response to nearly anything from teaching themselves new tech skills to searching for academic articles and research to finding a new apartment was simple: “Google it.”

Only one of the participants, a communications major, had talked about the issues of critical information literacy in a course at WU, and she was quick to point out that she had a personal network with diverse viewpoints and therefore she felt like she was able to avoid some of the pitfalls of personalized search functions. Other students said that they had been told back in high school to look at sources and citations in deciding what information is credible.

Unfortunately, new research indicates that even these tried and true rules of engagement are not working and the majority of middle and high school students, and even most college students, struggle to judge the credibility of online information sources (Wineburg, McGrew, Breakstone & Ortega, 2016).

None of the students, even those who commented on the tracking of their shopping habits, made the leap to question the dominance of the major players like Google or Facebook in influencing the flow of information or the ways that commercial interests drive these practices. As Taylor (2014) put it, “Web 2.0 is not about users buying products; rather, users *are* the product. We are what companies like Google and Facebook sell to advertisers... content is no longer king, as the digital sages like to say: connections are” (p. 14). She goes on to argue that Google is the most successful advertising company in the world, “commanding around half of

the online market” and earning billions in company profits almost exclusively from advertising revenue (Taylor, 2014, p. 184).

Additionally, students did not consider the ways that these commercial interests were influencing the type of information they receive when they look for answers by “Googling it.” The participants were confident that they would be able to find what they were looking for and determine what sources were credible and appropriate for their desired outcome. Commercial search engines like Google, benefit from a social belief in the neutrality of technology that acts as a blinder and dampens an individuals’ drive to critically evaluate resources and recognize misrepresentations of individuals and groups (Noble, 2013). As Pariser (2011) points out,

While the Internet offers access to a dazzling array of sources and options, in the filter bubble we’ll miss many of them. While the Internet can give us new opportunities to grow and experiment with our identities, the economics of personalization push toward a static conception of personhood. While the Internet has the potential to decentralize knowledge and control, in practice it’s concentrating control over what we see and what opportunities we’re offered in the hands of fewer people than ever before.

The participants are obviously not alone in being oblivious or resigned to the ways that the internet functions and influences information gathering and social interactions. And yet, unfortunately this was not something that the students had grappled with in classes or conversation during their time in college.

Only a few students were using social media to develop a professional network in preparation for their transition to a career after college, but nearly all of them had an active LinkedIn profile and were using the internet to gather information about careers and specific job opportunities. David and Carlos, who were leveraging online tools to advance their professional

careers, both had a group of mentors who had helped them navigate this process and had offered direct introductions and tips for building an online professional network. Students involved in undergraduate research were also benefiting from direct contact with expert faculty and graduate schools who could help them gain relevant technical skills and answer questions about potential careers. These interactions are an important component of developing career capital (Arthur et al., 1999; DeFillipp & Arthur, 1994).

Students gained hands-on experience and technical expertise in their research labs. This legitimate peripheral participation (Lave & Wenger, 1991) also helped many students to solidify their career goals. Internships were another positive experience for the participants in acquiring field-specific technical skills and narrowing their career goals, but most did not offer the same level of mentorship and ongoing support as the research labs. In addition, students generally gained more basic skills during their internships as opposed to the advanced technical skills acquired by students in research settings. Given the fact that students' internships represented a wide range of disciplines and professional fields, it is not surprising that some would focus more directly on technical skills than others. At the same time, students were expected to jump in and use a variety of digital competencies to support their work. Several students also parlayed their internships directly into more permanent positions after college, although most of these jobs were not directly related to their desired career field.

The majority of study participants were involved in numerous activities during college as they tried to build their resumes and gain valuable experiences. Nearly half of the students had both an internship and undergraduate research position during college, and nearly everyone had done at least one of these. Many also had paid positions on- or off-campus, and were active in student clubs. The only student who had did not pursue these types of opportunities had made a

decision to focus on his grades and LSAT score in preparation for his law school applications. The rest of the students were actively trying to gain relevant experience in college and there was a sense that they were hustling to take advantage of these resources before they graduated. Whether they knew it or not, the participants were building career capital by developing a plan for their career (knowing why), learning important skills and competencies to support their work (knowing how), and making academic and professional connections (knowing whom).

Career and economic uncertainty may have been a driving force in students' efforts to assemble a group of relevant experiences and to develop marketable skills. While some students were more concerned than others, there was a general sense among the participants that they were not guaranteed to find a job after college, especially one related to their chosen career field. In addition, the majority of students talked about gaining important soft skills in college such as communication and critical thinking but many struggled to articulate how their academic and pre-professional experiences translated to specific technical skills for their career. Yet, as a recent report on *The Future of Work* from the Chronicle of Higher Education noted, "more jobs will require recent college graduates to more fully merge their training in hard skills with soft skills" and "employment may become more tenuous, as computers and robots reinvent and even eliminate some kinds of jobs, while other jobs become freelance and part-time 'gigs'" (Carlson, 2017, p. 9-10). While the students recognized the importance of digital competence as a baseline for any career field, there was a feeling among many that they would gain more specialized and relevant technical skills on the job, which is a reasonable sentiment as long as they possessed an adequate command of foundational skills to support their ongoing training and advancement.

The participants' stories highlight the fact that there is no single formula for developing digital literacy and building relevant skills for a successful career transition. Students were

gaining most of their career-specific skills and knowledge of employer expectations outside of the classroom. While the participants were in many ways leveraging their status as undergraduates at a highly selective research university to gain access to internships, research positions, and professional networks, they also understood that these opportunities would not be handed to them as part of their college education. The university had a number of systems in place to support students in thinking about their career goals and gaining relevant skills – such as internship programs, the Career Center, and various fellowships – but with a huge student population and limited resources there was a sense that students had to figure much of this out on their own. For lower-income students who had less flexibility with regard to financing their education and using personal networks to find opportunities, this reality was all the more relevant and likely contributed to their decisions to pack their schedules with career-oriented learning experiences on top of their busy academic course loads.

CHAPTER 6: SUMMARY AND CONCLUSIONS

Digital literacy, as defined by Martin (2008), is the ability to use a range of digital competencies – including identifying, evaluating, organizing and analyzing digital resources, communicating information, and reflecting on the process – to support one’s activities in a particular community of practice. For Martin, digital literacy is “an attribute of the person in a socio-cultural context” and “an element of that person’s identity,” (2008, p. 167). The ability to navigate online spaces, critically evaluate information, and use a variety of computer programs and applications to support academic and professional work in collaboration with others is an essential component of today’s college student experience. This study sought to gain a deeper understanding of the experiences and individuals that influence students’ development of digital literacy during college, and how these skills and competencies impact their confidence in career planning, with a particular focus on lower-income students.

The study was guided by four broad research questions: (1) In what ways do personal background characteristics and early access to technology influence the development of digital literacy among college students? (2) What experiences and interactions during college influence the development of digital literacy among students? (3) In what ways does digital literacy influence college students' academic choices and professional career planning? (4) What are the main sources of information that students use to gather information about the technology demands of specific professional careers? Two complementary theories supported the framing of this study. Situated learning theory (Lave & Wenger, 1991) and Sims’s (2014) concept of differentiating practices helped to illuminate the ways that college students acquire and utilize digital literacy with specific communities of practice to accomplish academic and professional goals. The theories of boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur,

Inkson & Pringle, 1999) complemented this theoretical grounding to consider the ways that students develop and leverage relevant skills and networks to help them prepare for a successful career.

I used an explanatory sequential mixed method design (Creswell, 2014) with both quantitative and qualitative methods of data collection to gain insight from graduating seniors at a selective public research university. Data was collected and analyzed in two separate phases. During the first phase of the study I analyzed data from the annual survey distributed to all students eligible for graduation. Survey analysis included descriptive and comparative measures, and qualitative analysis of responses to an open-ended question related to the ways that students' college experiences had prepared them for the technology demands of the workforce. I also used structural equation modeling (SEM) to examine the relationship between various factors that predict students' confidence with regard to digital competence and professional career planning.

In the second phase of the study I interviewed 16 graduating seniors at the same institution. Through these interviews, I was able to follow up on some of the themes that emerged during the first phase of the study, and gain a more comprehensive understanding of students' early exposure to information and communication technologies (ICT), digital literacy in college, and what students were doing to prepare for their future careers. In the following sections I provide a summary of the major findings from each phase of the study followed by some implications of these findings for theory and practice, as well as the limitations of the study and areas for future research.

Summary of Findings

Developing Digital Competence from an Early Age

Findings from both the first and second phase of the study indicated that students' early exposure to computers and ICT, as well as their personal background, influenced their digital competencies and confidence during college. Survey data from the first phase of the study revealed that Pell Grant recipients reported more significant gains in digital competence during college, as measured by the *Digital Competence* construct in the structural models. As stated, this finding suggests that lower-income students may have entered college with less confidence in the digital competencies and that they gained new skills through their various experiences on campus.

Among interview participants, opportunities to tinker with their family computer and encouragement from family and peers when they were young were pivotal experiences in the development of digital competence. Students were active in various communities of practice where they gained specialized digital skills to support their engagement with peers. More than half of the students enjoyed playing online games when they were young, and a few were still active gamers in college. In addition, nearly all of the interview participants were active on social media from a young age and talked about using various tools and applications to communicate with their friends during school and at home. Students were socialized from a young age to use the computer, mobile phones, and the internet to engage in communities of practice with their peers. While students were gaining certain digital competencies in school, such as finding and organizing online information for assignments and typing essays, these activities did not tend to spark students' interests in computing and a range of digital tools. Even among students who gained more advanced skills such as coding with robotics or graphic design, these experiences

were often singular, isolated opportunities that did not connect directly with other components of the curriculum.

Advancing Digital Literacy in College

College students use a wide range of digital tools and competencies to support their academic work on campus, and the study participants were no different. Graduating seniors who participated in the survey were generally confident in their digital competencies such as the ability to navigate the internet, collaborate with peers using digital tools, and find information online. Pell Grant recipients, in particular, reported gaining new academic skills along with digital competencies in college that helped them to feel more confident in their preparation for a professional career after college. Although this finding indicates that lower-income students may feel less confident than their more affluent peers when they start college, it also suggests that the university was providing students with opportunities to gain new skills and build their confidence in preparation for a career after college.

The vast majority of survey respondents were confident in their ability to critically evaluate online information and resources although conversations with the interview participants provided a more nuanced understanding of this topic. The interview participants were also quite confident in their ability to find and vet online resources pointing to recommendations they had received in high school about looking at sources and using reputable websites. Yet, these students had given very little thought to the commercial interests influencing the flow of information on the internet and the ways that personal search algorithms were tailoring information to their preferences and interests. Only one of the students had discussed these issues in an academic course during college, and most had not given it much thought despite the fact

that they received news and current events through social media and online applications designed to aggregate and curate news for particular audiences.

Data from both survey and interview participants indicated that students were developing much of their digital competence outside of their academic classes. Responses to the open-ended survey question about the ways that college had prepared them for the technology demands of work offered both positive and negative comments about the opportunity to develop new skills and build confidence in their courses. Many students reported improving their presentations skills, basic operations in Microsoft Word and Excel, and using online collaboration tools such as Google Docs. Yet, students indicated that most faculty members were not leveraging technology to support instruction or strengthen the curriculum, which bothered some students more than others.

These sentiments were echoed by interview participants who were much more likely to talk about the digital competencies they had acquired through internships, research appointments, on- and off-campus jobs, and other co-curricular campus activities. Several students had gained field-specific technical skills through internships and research that they felt would be useful for their future career, although many participants reported more broad computing skills such as designing presentations, organizing data with Excel, and online communication and marketing. At the same time, participation in an internship or research during college did not predict greater confidence in digital competence in the structural model predicting preparation for the technology demands of work. This finding was somewhat concerning since these pre-professional experiences are in many ways designed to give students hands-on training for a specific discipline or industry that would ideally include related computing and digital literacy skills.

Building Career Capital

Undergraduate research positions and internships were positively related to students' feelings of preparation for their chosen career field and the transition to work after college. In the structural models predicting confidence in one's preparation for the job market and technology demands of work, internships were positively correlated with both outcomes, and participating in research was positively correlated with confident in preparation for the technology demands of work. Among interview participants, nearly all of the students had completed an internship or had a research position during college, and the majority reflected on these experiences as positively contributing to their knowledge and expertise for particular career interests and goals. Further, many students, especially in laboratory research settings, built relationships with mentors with whom they were able ask questions and talk about their career goals. Through these pre-professional experiences, many students gained important career capital – knowing-why and knowing-how – by refining their professional aspirations and acquiring digital competence and other relevant skills.

Interview participants also spoke of the various ways that they learned about their career field and specific opportunities, including through their interactions with professors, mentors, employers, friends, family, and colleagues. These personal networks represented the third component of career capital: knowing whom. A few students were very savvy in using online tools such as LinkedIn, Facebook, and online career boards and networks, but the majority were still learning how to use these tools to connect with professionals working in their field and to prepare for the job search. Some students used campus resources such as the career center, scholarships and internship programs, and departmental postings to help them build a professional network, but an equal number reported that they had a hard time finding and using

such resources. A few of the students were able to take advantage of personal and family connections or the guidance of a professor or campus administrator with whom they had made a personal connection, but for the rest it would have been beneficial for the university to take a more active role in helping students to draw connection between their academic coursework, co-curricular experiences, and the kinds of skills and competencies that employers across the spectrum and in their own field would be expecting.

Implications

Implications for Theory

Martin's (2008) conceptual framework was a useful guide for understanding digital literacy in this study. As a three-level framework, Martin highlights the need for foundational skills (digital competencies) to thoughtfully engage in online information and collaborative spaces. As such I was able to consider the ways that college students develop this skillset and their confidence in navigating computers, the internet, and other digital tools. Additionally, the second and third levels of the framework – which encompass digital literacy – were focused on the sociocultural aspects of an individual's engagement with these digital tools, and therefore worked well with the theoretical frameworks guiding the study. Sims's (2014) theory of differentiating practices is focused on the ways that peer groups and communities of practice influence the young people's digital competence, and the theories of boundaryless careers and career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999) place the individual and their actions at the center of the professional development process.

The challenge with Martin's (2008) conceptual framework is that it falls short with regard to critical information literacy. While digital competence encompasses 13 skills necessary

for the development of digital literacy, it does not address the issues of power and privilege in digital spaces. As the literature discussed, the computer and internet industries are heavily influenced by commercial interests and it is therefore important that students gain a deeper understanding of the various actors and interests who influence the flow of information and capital related to digital tools and spaces. Further, this study highlights the challenges of separating digital literacy from critical information literacy.

During the in-depth conversations with the interview participants in the second phase of the study, it became apparent that these students had not encountered many conversations about digital literacy and critical literacies in their academic courses. While the survey data indicated that students were very confident in their ability to critically evaluate online sources, these conversations revealed that their confidence was built on a narrow set of social practices that most students established in high school to look for sources and to visit reputable websites such as Google Scholar and major media sites like the New York Times and Wall Street Journal. Beyond that, the students in this study had not given much thought to the commercial interests driving online innovation and the flow of information. Most were either unaware or had not given critical thought to the fact that advanced algorithms were working hard to track their user behavior and tailor their search experience to match their personal interests and preferences. In addition, nearly all of them were receiving and accessing the majority of their news and information about current events through social media and other news aggregators without much concern for the filtering effects of this approach.

As such, building on Martin's (2008) conceptual framework for digital literacy and advancing a theory that incorporates research and theory from the fields of critical information literacy (e.g., Eisenberg, Lowe & Spitzer, 2004; Elmborg, 2006) and critical media literacy (e.g.

Alvermann & Hagood, 2000; Kellner & Share, 2006) would be highly advantageous. This study contributes to the current literature on college students' digital literacy in academic and pre-professional communities of practices, and highlights the need for colleges and universities to incorporate a more robust and critical discussion of digital literacy into academic communities of practice for undergraduates in all fields.

Implications for Practice

As noted in the previous section, institutions of higher education have an important role to play in supporting the development of digital literacy among college students. In addition, colleges and universities should focus more attention on helping all students find opportunities to gain hands-on, practical experiences related to their career interests and then provide resources to help students draw connections between their college experiences and relevant skills for their transition to the workforce. Findings from both phases of the study indicated that students' pre-professional experiences such as internships and research positions were positively correlated with their confidence in preparation for the job market and the technical demands of their chosen career field. And yet among survey respondents who planned to seek employment immediately after graduation only a quarter had completed an internship in college and one third had participated in undergraduate research. Pell Grant recipients, from lower-income families, were even less likely to complete an internship during college than their higher-income peers.

As previously stated, internships, research appointments, and other paid positions helped students to hone their field-specific technical skills and career goals as participants in specific communities of practice that include observation, hands-on training, and mentorship. According to Burning Glass Technologies (2006), a company that analyzes labor market trends using metadata from job postings, there are significantly more opportunities for new college graduates

who have a combination of these technical skills, or hard skills, along with a range of soft skills such as critical thinking and intercultural communication. In addition to a deep knowledge of discipline specific concepts and technical applications, the authors also assert that new graduates with technical skills such as basic coding, social media, and web design are qualified for significantly more jobs.

Unfortunately, as this study and previous research suggest, most college students do not acquire these skills as part of their undergraduate experience. Many universities, including the one in this study, offer computing courses for non-majors, but according to both survey respondents and interview participants these courses are often oversubscribed and require a certain level of background knowledge. Digital literacy has become an essential component of academic and professional interactions, and therefore institutions of higher education may want to consider new ways to support students in gaining digital competencies and more advanced computing skills through workshops, credit-bearing courses, interdisciplinary projects, and active learning pedagogies.

While some argue that the central role of higher education is not to help students find a job and succeed professionally, numerous surveys indicate that this outcome is of utmost importance to students and their families, especially considering the rising costs associated with enrollment (e.g., Eagan, Stolzenberg, Bates, Aragon, Suchard & Rios-Aguilar, 2015). Findings from the second phase of this study highlight the fact that many college graduates struggle to articulate the ways that their academic and co-curricular experiences in college have prepared them for career success. Drawing these connections, or “knowing-how,” is a central tenet of the concept of career capital (Arthur & Rousseau, 1996; Arthur, Inkson & Pringle, 1999). A recent report from the *Chronicle of Higher Education* entitled, *The Future of Work*, noted that the role

of career centers is shifting to focus more on helping students get connected with professional networks, offering career development resources, and leveraging information and communication technologies to scale their operations and serve more students (Carlson, 2017). In addition, some institutions are rethinking how they manage their alumni networks to make them more accessible and responsive to students seeking advice and hands-on experiences, as well as partnering with faculty to share insights and expertise with students.

Helping students prepare for a successful transition to work after college does not have to take away from the academic mission and focus of higher education. To the contrary, research indicates that employers want to hire recent graduates who have deep knowledge in their particular career field coupled with soft skills and digital literacy (Carlson, 2017; National Association of Colleges and Employers, 2016). Career capital is in many ways based on the ability to recognize the value in various academic and professional experiences, seek out opportunities to gain specialized skills, and communicate this expertise to colleagues and potential employers. Therefore, universities can support students in preparing for graduation by strengthening pathways for all students to gain these essential skills by incorporating more active learning and connections to practice in academic courses, increasing the visibility and resources offered through the career center, and providing more opportunities for students to participate in career-oriented activities such as workshops, internships, research, job talks, faculty research presentations, and more.

Limitations and Future Research

Although this study shed light on the various ways that college students develop digital literacy and build confidence for their transition to professional careers after graduation, there

were several limitations and areas for future research. In particular, this study focused on a single point in time when college students were nearing graduation and making plans for their next steps, and was therefore unable to directly account for the variability in students' digital literacy at the point of entry into higher education. In future research, it would be beneficial to use a longitudinal research design that measures students' digital competence in their freshman year and then again at graduation to more fully consider the various experiences during college that directly contribute to improving these skills.

In addition, the current study was focused exclusively on students' perceived levels of digital literacy and did not utilize direct measures of particular skills. While this design provided valuable information about the ways that students perceive of their own skills and experiences, and the connection between these skills and their professional career planning, it would be useful to advance rubrics and exercises to better understand how college students interact with online resources and collaborative spaces. Martin's (2008) conceptual framework for digital literacy provides 13 specific competencies, or foundational skills, and future research could use this framework to develop rubrics, activities, and even curriculum to guide educators in teaching and measuring these skills among younger students in school as well as college students.

These rubrics could also be used to better understand the range of skills that students gain from hands-on training in communities of practice such as internships and research appointments. Study findings offered only a weak connection between students' participation in internships and undergraduate research and their confidence in digital competencies, despite a strong connection to students' confidence in their preparation for the job market and technology demands of work. Therefore, future research could focus on the specific competencies that students gain through participation in communities of practice that offer mentorship, hands-on

training, and specialized knowledge about the culture and skillset associated with specific career fields to help universities identify best practices and expand opportunities for students to gain important skills for their transition to work.

Descriptive analysis of study responses indicated that there was some variability in students' digital competencies based on the academic division of their major (i.e., humanities, social sciences, life sciences and physical sciences). It is unclear whether or not these differences were based on experiences and interests before college, students' academic coursework and pre-professional experiences during college, or their specific career goals and perceptions of the demands of their chosen field. Further research focused more directly on academic divisions would help parse out this variability and provide valuable information about some of the differences and challenges across students' college experiences with regard to digital competencies and literacy.

Finally, this study focused on a single institution and therefore findings should be generalized to consider other universities or student populations with great caution. Digital literacy and 21st century skills are often touted as essential outcomes of schooling and higher education to prepare young people for engaged citizenship and employment, and yet there is very little consensus about the definition of these concepts and only limited information about national trends. Future research that gathers data from multiple institutions would provide useful information about students' experiences at different types of institutions, on campuses more closely aligned with local economic trends and industry partners, and at universities that serve students from specific geographic regions, racial groups, or academic backgrounds.

Concluding Remarks

Most students on college campuses today are members of the first generation to have grown up with computers in their classrooms, unlimited access to news and information on the internet, and smart phones that help them do everything from finding a restaurant to writing a review of that restaurant to sharing pictures of their meal with friends and acquaintances around the world. Their academic experiences have been fundamentally different than members of previous generations, with some arguing that their brains process information differently and that they can multitask and navigate online spaces in new and different ways. While there are plenty of skeptics who question the extent to which information and communication technologies have influenced literacy, communication, and commerce, there are just as many who worry that these rapid changes are fundamentally impacting society and individuals for better or worse.

This study sought to gain a deeper understanding of the kinds of experiences, individuals, and groups that influence college students in gaining digital competencies and advancing those skills in specific communities of practice to develop digital literacy. Previous research points to a disconnect between college students' academic experiences and employers' expectations (e.g., Arum & Roksa, 2014; Burning Glass Technologies, 2014; Carlson, 2017), and to the changing nature of work and the resulting implications for professionals in wide ranging fields (e.g., Carr, 2014; Brynjolfsson & McAfee, 2014). It is therefore important to understand the level and range of digital skills and competencies students bring to college campuses, and their confidence with regard to leveraging these skills to advance their academic pursuits. As this study highlights, most students were quite confident in their digital competencies, such as communicating online, finding resources, and using basic applications for writing and presentations. Participants were less confident in advanced computing skills such as coding, design, and computation, and lower-

income students were still significantly less confident in these areas and less likely to have gained access to meaningful learning opportunities to develop these skills in school. More research is needed to understand how these differential learning experiences influence social practices and career aspirations.

Additionally, study findings indicate that students are benefiting from hands-on learning experiences outside of the classroom as they explore and refine their career goals. These opportunities help students build career capital and confidence to tackle the job market after college, but the limited relationship between these pre-professional experiences and students' confidence in digital competencies in the structural model and interview data indicates that either students are not gaining important skills for the workforce or they aren't learning how to articulate these skills as essential components of career preparation. Further, lower-income students are participating in fewer internships and are working more hours in unrelated jobs, limiting their ability to develop career capital. Colleges and universities need to do more to help students bridge this gap, and additional research could advance our understanding of learning outcomes from these important professional learning experiences.

Finally, while this study did not delve into the realm of critical information and media literacies, it did highlight the fact that few college students, even at a highly selective university, have a critical understanding of the ways that information and communication technologies, and the commercial interests driving their development, are influencing society and changing the way individuals communicate, learn about individuals and groups, and participate in civil society. As members of the generation of "digital natives," college students are a natural choice to lead the charge in grappling with these challenging issues, and colleges and universities

should ensure that all graduates have the opportunity to participate in communities of practice that recognize, examine, and address these important issues.

Marisol and Adina, who were introduced at the beginning of the study, were both dynamic and motivated students who have now graduated and likely entered the workforce. These two women, just as the students in the current study, will face many successes and challenges throughout their careers, and will surely adapt to the changing demands of their career fields as best they can. Their stories though highlight the ways that early experiences with computers and ICT can have a ripple effect that follows young adults to college and beyond. Unless institutions of higher education are willing to grapple with the challenges of serving students with all levels of digital literacy, to consider the best ways to balance academic rigor with preparation for the transition to work, and to engage students in meaningful conversations around critical literacy in the digital age, they are missing an important opportunity. Students on today's college campuses bring a wealth of diverse experiences and expertise related to computing and ICT that will influence academic, professional and social communities of practice at the institution and beyond, and ensuring that all students, regardless of their financial background, have a voice in this discussion is a challenge that colleges and universities should embrace and champion.

Appendix A. Processes of Digital Literacy, Martin (2008)

Process	Descriptor
Statement	To state clearly the problem to be solved or task to be achieved and the actions likely to be required
Identification	To identify the digital resources required to solve a problem or achieve successful completion of a task
Accession	To locate and obtain the required digital resources
Evaluation	To assess the objectivity, accuracy and reliability of digital resources and their relevance to the problem or task
Interpretation	To understand the meaning conveyed by a digital resource
Organization	To organize and set out digital resources in a way that will enable the solution of the problem or successful achievement of the task
Integration	To bring digital resources together in combination relevant to the problem or task
Analysis	To examine digital resources using concepts and models which will enable solution of the problem or successful achievement of the task
Synthesis	To recombine digital resources in new ways which will enable solution of the problem or successful achievement of the task
Creation	To create new knowledge objects, units of information, media products or other digital outputs which will contribute to task achievement or problem solution
Communication	To interact with relevant others whilst dealing with the problem or task

Dissemination	To present the solutions or outputs to relevant others
Reflection	To consider the success of the problem-solving or task-achievement process, and to reflect upon one's own development as a digitally literate person

Appendix B. Technology Questions, Senior Survey 2015

Rate yourself on each of the following traits as compared with the average person your age.

We want the most accurate estimate of how you see yourself.

[RESPONSE: 1= lowest 10%, 2=below average, 3=average, 4=above average, 5=highest 10%]

- a. Ability to navigate the internet for academic research purposes
- b. Computer programming and coding
- c. Confidence with learning new programs and apps
- d. Ability to critically evaluate online sources
- e. Ability to engage in social media for personal communication
- f. Ability to engage in social media for professional purposes
- g. Effective communication skills in online spaces and forums
- h. Website design

Thinking back on your experiences at [Western University], indicate your level of agreement with the following statements related to technology (i.e., computers, internet, information and communication technologies, social media)

[RESPONSE: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree]

1. I am confident in my ability to critically evaluate online materials and sources.

2. I am able to effectively communicate ideas and concepts in online and technology-assisted formats.
3. I believe that having strong skills and expertise related to technology is an essential tool when you enter the professional workforce.
4. I have gained new skills and expertise related to technology in my college courses.
5. I have gained new skills and expertise related to technology in my undergraduate research experiences.
6. I have gained new skills and expertise related to technology at an internship or professional experience during college.
7. I am confident that I have the necessary skills and expertise for the technology demands of my future profession.

How have your experiences at [Western University] helped to prepare you for the technology demands of your future profession? (i.e., online marketing, presentation skills, computational skills)

[RESPONSE: TEXT BOX]

Appendix C. Interview Participant Questionnaire

Section I: Post-Graduate Plans

1. Name [TEXT BOX]
2. Do you plan to complete your degree and graduate in spring quarter 2016?
3. What is your primary plan in the six months after graduation?
[1=Get a job/continue working, 2=Start graduate school, 3=Travel, 4=Volunteer, 5=Unsure/no immediate plans, 6=Other, with open text box]
4. *If student answer to question 3 is #1: (Skip logic)*
You indicated that your primary plan after graduation is to seek employment. Please describe the type of job you will pursue. [TEXT BOX]

Section II: Digital Competencies and Literacy (Martin, 2008)

5. Did you take any college courses that discussed critical literacy or information and communication technologies? [1=Yes, 2=No]
 6. If yes, what courses? [TEXT BOX]
- ***Digital literacy is the ability to use a range of digital tools to communication with others, synthesize information, and construct new knowledge, in the context of specific life situations (personal, academic, professional) to enable constructive action.*
7. Do you consider yourself to have a high level of digital literacy? [“absolutely not, I hate technology”=1... “absolutely, I’m an early adopter and use technology constantly”=10]
 8. Do you consider yourself to have a high level of digital literacy skills related to your academic field? [“absolutely not, I don’t use tech in my field=1... “absolutely, tech is essential to my academic work”=10]

9. Do you consider yourself to have a high level of digital literacy skills related to your professional career goals? [“absolutely not, I don’t even know what skills I need for my future career=1.... “absolutely, I’m prepared to use tech effectively at work”=10]
10. Rate your level of skill and knowledge in each of the following areas, in comparison to your peers at [WU]: [1= lowest 10=highest, no descriptions in between]
- a. Identify digital resources required to complete a particular task (*Identification*)
 - b. Finding research articles and academic resources online (*Accession*)
 - c. Critically evaluating the reliability of information and sources online (*Evaluation*)
 - d. Understand the underlying meanings, viewpoint, biases, or purpose conveyed in a digital resource (*Interpretation*)
 - e. Organize digital resources and information for easy access and analysis (*Organization*)
 - f. Utilize database or other applications to organize information and resources from various sources (*Organization*)
 - g. Solve problems or complete tasks using a range of relevant digital resources (*Integration*)
 - h. Analyze information from relevant digital sources to support academic tasks (*Analysis*)
 - i. Analyze information from relevant digital sources to support professional tasks (*Analysis*)
 - j. Remix and reuse digital resources and information in new ways to achieve academic tasks (*Synthesis*)
 - k. Remix and reuse digital resources and information in new ways to achieve professional tasks (*Synthesis*)
 - l. Create products and presentations using digital resources, applications or platforms (*Creation*)
 - m. Utilize digital resources, applications or platforms to share new knowledge or information with others (*Creation*)
 - n. Communicate and collaboration with friends and peers using online and social networking platforms (*Communication*)

- o. Communicate and collaboration with coworkers and professional contacts using online and social networking platforms (*Communication*)
- p. Share information online using blogs, personal websites, etc. (*Dissemination*)
- q. Utilize field-specific software and programs to complete assignments and projects (e.g., statistical software, visualization tools, engineering and design)

ICT Usage

11. What is your primary source of news and current events? [Check all that apply: 1=Traditional sources (TV/radio/newspaper), 2=Social media (e.g., Facebook, Twitter), 3=News websites (e.g., NYTimes.com, CNN.com), 4=Other with text box]
12. Describe your social media presence? [TEXT BOX]
13. Do you have training in computer programming? [1=Yes, 2=No]
 - a. If yes, explain. [TEXT BOX]
14. What devices do you own and use regularly? [Check all that apply: 1=smart phone, 2=desktop computer, 3=laptop computer, 4=tablet/iPad, 5=eReader, 6=game console, 7=other]
15. Do you have a profile on LinkedIn or other professional networking website? [1=Yes, 2=No]
16. Where do you look for information about open positions and jobs in your field? [TEXT BOX]

Section III: Personal Background

1. Did you enter [WU] as a: [1=Freshman, 2=Transfer student]
2. What is your academic major? [OPEN]
3. How do you identify? [1=Female, 2=Male, 3=Other, 4=Decline to state]
4. Please identify your race/ethnicity. [OPEN]
5. What was the primary language spoken in your home during childhood? [OPEN]
6. High school characteristics [1=Urban public, 2=Urban private, 3=Suburban public, 4=Suburban private, 5=Rural public, 6=Rural private]

7. Are you the first in your immediate family to graduate from college?

[1=Yes, 2=No]

8. Did you qualify for or receive need-based financial aid during college? [[1=Yes, 2=No]

9. What is your parent/guardian's combined income level? [Scales]

Section IV: Follow-up Interview

Are you interested in participating in a follow-up interview to discuss these issues in greater detail? All participants will receive a \$10 gift card at the completion of interview.

[Yes/No]

[Email]

Appendix D. Qualitative Interview Protocol

Introduction

1. How/why did you decided to come to [WU]?
2. Tell me a little about your experience at [WU] including:
 - a. Major? Department?
 - b. Did you live on campus?
 - c. Activities and communities on campus?

Early experiences with technology

1. Tell me about your early experiences with computers and the internet at home.
 - a. When did you get your first computer? Personal or family computer?
 - b. Did you have high speed internet at home?
 - c. Do your parents use computers/internet/ICT regularly? Siblings?
2. What were your primary activities on the computer/internet when you were younger/before you got to college? (i.e., gaming, social media, communicating with friends/family, school work, videos)
 - a. Were you engaged in these activities with friends? Family?
 - b. Follow up on social aspects of specific activities (e.g., gaming with friends, learning programs from family, school activities)
3. What other devices did you have access to? (i.e., mobile phone, iPad, etc.)
4. How did you use computers/internet/other apps in school?
 - a. Computers in the regular classroom? (individual, computer cart, handful shared)
 - b. What grade did you first start using computers?
 - c. What did you do with computers at school?
 - i. Math quizzes? Word games? (Drill & test)
 - ii. Research and information seeking?

- iii. Group projects and presentations?
 - iv. Computer science and coding?
 - v. Media, video, etc.?
 - vi. Communicate with teacher, assignments, check grades, etc.?
- d. Special clubs/activities? (Robotics, newspaper, graphic design)
5. Were computers and digital technologies used effectively at your school? Why or why not?

Tech usage in college

1. What devices do you use every day?
 - a. How often are you online? On your computer? Mobile phone?
2. What are your most common activities on your computer and online?
 - a. Do these activities involve your friends?
 - b. To what extent do your friends influence your choices?
3. Tell me about your social media presence?
 - a. Social? Academic? Professional?
 - b. Connected to college activities? (Activism, pre-professional, etc.)
 - c. Staying connected with friends and family? Professional networks? Academics?
4. What sources of information do you use for news and current events? (traditional, online, social media, etc.)
 - a. Do you feel well-informed?
 - b. Why do you choose this medium for gathering information?
 - c. How do you decide what sources of information are credible?
5. How much did your instructors use technology to support teaching and learning in your classes at [WU]?
 - a. Do you wish it was more or less?
 - b. Was the technology-supported instruction effective?

6. Did you learn career-specific tech skills in your courses in the major? (e.g., statistical programs, laboratory equipment, data/information management)
 - a. Do you wish your courses focused more/less on these types of skills?
7. Did you participate in undergraduate research during college (research apt/course or honors thesis)?
 - a. What types of skills did you gain from this experience, specifically relate to your career goals?
 - b. How much did you work with your faculty mentor?
 - c. Did this experience influence your career goals?

Defining digital literacy

1. What does the term digital literacy mean to you?
 - a. Follow up with definition and discussion
 - b. Do you consider yourself to have strong digital literacy skills?
 - i. For academic purposes? Professional purposes?
2. Digital literacy skills (Martin, 2008):
 - a. Review and expand on responses to questionnaire for Digital Competencies

Career planning and information gathering

1. Where (or from whom) do you gather information about career opportunities and jobs in your field? (family, friends, professors, counselors, online info, ETC.)
 - a. Why do you feel this is your best source of information? (Easiest, most knowledgeable, most comprehensive, don't know about other)
 - b. How easy is it to find this kind of information?
2. Do you have a LinkedIn profile or presence on other professional networking sites?
 - a. Activity with professional organizations?
3. How much do you know about employer's expectations for new graduates/entry-level positions in your field?

- a. What kinds of skills and competencies will you need?
4. How important is it for you to have a range of technical skills? (general skills and field specific)
 - a. How confident are you that you have the appropriate skillset for your desired job after college?
 - b. Do you expect to get a lot of training and guidance on the job?
 - c. How comfortable are you in learning new computer programs and applications related to your career field?
5. What college experiences have influenced your attitudes and confidence with regard to computing and ICT specifically for your transition to work?

Plans after graduation

1. What is your plan for the first six months after graduation?
2. Why are you choosing to join the workforce directly after graduation?
3. What do you think are the most important qualities that employers are looking for in hiring new employees?
4. What are the most important skills you have developed in college for your transition to a professional career?
 - a. What are the most important skills you have developed in college, related to computers and ICT?
5. How prepared do you feel to tackle the job market and find a new professional opportunity in your field?
6. How confident are you that you'll find a job in your field/related to your desired career?

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