

Examining how academic discipline and demographics affect the web-use skills
of graduate and professional students

Jennifer Owens, MS
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Approved by: _____
Advisor: Kathryn Summers, PhD

Committee Member: Roger Ward, EdD, JD, MPA

Committee Member: Greg Walsh, PhD

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Abstract

Background and Purpose: The concept of a homogenous group of tech savvy digital natives has recently been refuted empirically and theoretically through comprehensive literature reviews (Jones & Shao, 2011; Bennett, Maton, & Kervin, 2008). Instead, digital natives have been found to possess a large variation of technology use and skills (Kennedy et al., 2007). In addition, the argument for supporting the idea of digital natives is often criticized for neglecting to study race, socioeconomic factors, and previous experience with technology (Vaidhyathan, 2008). Although there is a growing body of literature about the digital literacy of undergraduate students, there has been little, if any, research completed on the population of graduate and professional students. There are educational differences between graduate and undergraduate students (Hussey & Smith, 2010; Artino & Stephens, 2009; Seligman, 2012), and among academic disciplines there are varying degrees of technology use (Weng & Ling, 2007; Fry, 2004; Fry, 2006; Guidry & BrckaLorenz, 2010). The primary purpose of this study was to examine whether academic discipline is associated with web-use skills among the graduate and professional students at the University of Maryland, Baltimore. The secondary purpose of this study was to examine how age, gender, race, parental education, international status, GPA, and self-perceived skills affect web-use skills.

Methods: Hargittai and Hsieh's Web-use Index was adapted as the instrument for this study (2012). The instrument has been found to be a proxy of participants' observed web-use skills (Hargittai, 2005). The Web-use Index was distributed online via a survey to the entire population of 4,996 potential participants. Six hundred and ninety-nine participants completed and returned the survey. After reviewing and removing unusable data, five hundred and fifteen eligible participants remained in the sample. To analyze the data, the Kruskal-Wallis H test was chosen

because of its use for independent samples. The Fisher's LSD test was used for post hoc analysis to determine statistical differences between groups.

Results: The results showed that academic discipline affected nine of the twenty-seven web-use variables. There were statistically significant differences ($p < 0.01$) for the following variables: phishing, preference setting, reload, rss, tabbed browsing, tagging, torrent, web feeds, and wiki. Overall, it appears that the highest scores were from the School of Law and the lowest scores were from the School of Nursing. Race/ethnicity had an effect on ten of the twenty-seven variables. There was statistical significance ($p < 0.01$) for the variables bookmarklet, cache, frames, phishing, rss, social bookmarking, torrent, web log, widget, and wiki. It appears that Asian/Pacific Islander participants had the highest scores and Hispanic participants had the lowest scores. Gender was statistically significant for eighteen of the twenty-seven variables. The variables significant for gender included cache, firewall, frames, jpg, malware, newsgroup, phishing, podcasting, preference setting, reload, rss, spyware, tabbed browsing, torrent, web feeds, web log, widget, and wiki. Male participants outscored female participants on every variable. Age was statistically significant for three of the twenty-seven variables including tabbed browsing, tagging, and torrent. GPA was only statistically significant for one of the twenty-seven variables, which was social bookmarking. The results showed no statistical significance for International Status or Parental Education.

Conclusion: Gender plays a larger role in the digital literacy of graduate and professional students than other demographic factors. This may be due to a plethora of factors influenced by gender including family life, self-efficacy, and access to technology. The high scores of Asian/Pacific Islander students does not depart from literature within the study of digital literacy or academic achievement in general, but other findings from this study about the impact of race

were unanticipated. An unexpected finding was that African Americans scored higher than Caucasian participants on the Web-use Index. In the literature, African American students report knowing less about the Internet (Hargittai, 2010) and score lower on tests measuring information and digital literacy (Sexton, Hignite, Margavio, & Margavio, 2009; Jackson et al., 2008; Ritzhaupt, Feng, Dawson, & Barron, 2013). It can be hypothesized that since participants in the study are already in graduate or professional school, the effect of the socioeconomic advantage or disadvantage of their race on web-use skills is offset. While gender and race was associated with the digital literacy of graduate and professional students, parental education was not. This finding marks an interesting difference between graduate and undergraduate students and is a unique contribution to the literature. The conversation surrounding the effect of gender and race is important in the context of digital inequality. Due to relationship of demographic factors and digital inequality, faculty, staff, and policy makers should take action by creating initiatives that address the skill and availability of social support for graduate and professional students.

Key words: Digital natives, digital literacy, information literacy, socioeconomic factors and digital literacy, graduate and professional students

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CHAPTER 1

1.1 Background

In 2001, Marc Prensky and others began the ‘digital native’ debate by claiming the new generation of students were inherently digitally literate because they have always known a world with the Internet and computers (Prensky, 2001; Tapscott, 1998; Oblinger & Oblinger, 2005). Inclusion in their proposed digital native social cohort was based on age and includes those born after 1980 when the PC became commonplace (Oblinger & Oblinger, 2005). In addition, Prensky proposed that due to exposure and immersion in technology, students had developed radically new cognitive capabilities and learning styles (2001). Proponents claim that digital natives differed from those born before 1980, who Prensky labeled “digital immigrants.” Prensky (2001) claimed that digital immigrants would always retain their non-native speaking “accent” and would never fully be able to adapt to their new digital environment.

Digital natives are characterized as having a high level of digital aptitude and literacy, being constantly connected online, wanting information to be procured quickly and accurately, their ability to multi-task, their dependence on technology to maintain social contact, their openness to share content, and their ability to rapidly understand and adopt new technologies (Dede, 2005; Oblinger & Oblinger, 2005). Since this concept has become popular, an abundance of other terms have been coined with many subtle variations such as the “Net Generation” (Tapscott, 1998), “Millennials” (Howe & Stauss, 2000), and “Generation Y” (Jorgensen, 2003). Each name varies slightly, but the terms are often used interchangeably (Jones & Shao, 2011).

There has been much discussion and debate among academics, practitioners and policy makers surrounding the characteristics and abilities of digital natives. Advocates of digital natives claim 1) there is a single new generation of new students who make extensive use of new

technology; 2) there is a gap between learners and teachers; and 3) education needs to change to meet the learning styles of new students. The early research on this topic made bold claims about digital natives' characteristics and abilities, but is often criticized for lacking adequate methodologies (Bennet & Maton, 2010).

An example of an early claim championing generational characteristics is the one made by Howe & Strauss (2000). In their book *Millennials Rising*, Howe and Strauss coined the phrase 'Millennials' and made sweeping claims about the characteristics of that generation. An examination of the methodology by Hesel and May (2007) raised questions about the design of Howe and Strauss's study. Although they used a wide variety of sources including government agencies and Internet user groups, many of these sources were anecdotal (Hesel & May, 2007). In addition to their anecdotal sources, they conducted a survey of 600 students and teachers in a wealthy suburb in Fairfax, Virginia. In Fairfax, the median household income is over twice the national average and racial diversity comes mainly from Asian Americans, while African Americans and Hispanic students were underrepresented compared to the national average (Hesel & May, 2007). The socioeconomic assets of the participants in the study are not reflective of the generation as a whole, and it is likely that this sample is very different from the majority of students in their digital native age cohort.

The concept of a homogenous group of tech savvy digital natives demanding changes to pedagogy has recently been refuted empirically and theoretically through comprehensive literature reviews compiled by Jones and Shao (2011), and Bennett, Maton, and Kervin (2008). In addition, the argument for supporting the idea of digital natives is often criticized for neglecting to study race, socioeconomic factors, and previous experience with technology (Vaidhyanathan, 2008). Bennett and Maton (2010) called the concept of digital natives a

‘certainty-complacency spiral’ and observed the uncritical reproduction of the term gives digital natives undeserved credibility and significance.

Overall, evidence shows that today’s students are not a single group or generation with common characteristics, but who instead have various interests, motives, and behaviors. Jones and Shao’s recent literature review found that there was “no evidence that there is a single new generation of young students entering higher education and the terms net generation and digital native do not capture the processes of change that are taking place” (2011, p. 1). In addition, Jones and Shao (2011) found that “demographic factors interact with age to pattern students’ responses to new technologies” (2011, p. 1). Kennedy et al. (2007) studied 2,500 first-year students and found a large variation of technology use among the students, while Kennedy et al. (2008) found very little difference between how digital native students and their digital immigrant teachers use technology.

In light of the critical response, these generational arguments are still popularized and preached as a science throughout educational culture, perpetuating Bennet and Maton’s ‘certainty-complacency spiral’ (2010). One can’t look through their LinkedIn newsfeed without seeing another article about ‘*How to Help Millennials Learn*’, or *How to Be a Good Employer for Tech-Savvy Generation Y.*’ Marketing this concept to universities is big business; universities are paying handsomely for advice to help them understand their new students (Hoover, 2009).

So if university students aren’t inherently digitally literate, how digitally literate are they really? Hargittai (2010) found that considerable variation exists even among college students with high levels of Internet access when she completed her study in 2008 of 1,060 first-year students, most of them 18 and 19 years old. She controlled the variables of education and age, and found that most of them were highly “wired” with multiple points of Internet access. For the

study, the students provided a self-assessment of their web experience and web use skills. She found that those from families with at least one parent holding a graduate degree exhibit statistically significantly higher levels of know-how about the Internet than others (2010). In addition, she found that students of lower socioeconomic status, women, students of Hispanic origin, and African Americans exhibit lower levels of Internet literacy than others and engage in fewer information seeking activities (2010).

Kennedy, Judd, Dalgarno, & Waycott (2010) conducted a study of 2,096 first-year students between ages 17 and 26 from three Australian universities to learn more about their technology skills and preferences. They found that only 15 percent of the students were advanced users of technology and almost half of the students were basic users, using only standard web-based applications and mobile phones. It appears that a subset of students in their study fit the concept of the tech-savvy digital natives, but these students are in the minority. “In a single class at a university there are major differences in students’ experiences and preferences in relation to technology” (Kennedy et al., 2010). Kennedy et al. did not collect demographic information for participants, so although it is apparent there are differences in skill, it is not possible to see if socioeconomic factors had any influence in their study.

Most of the literature about digital natives has focused on the skills and abilities of undergraduate students. Many graduate and professional students also fall under the same age range as digital natives, which at the time of this study is 35 years old and younger. Every ten years the Department of Education surveys students for basic demographic information, and in 2010 the average age of graduate students in the United States was 32 (U.S. Department of Education, 2010). This falls within the bounds of the age cohort of digital natives. The lack of research on graduate and professional students has been attributed to a belief that graduate

students have adequate skills because they have advanced through an undergraduate experience (O'Donnell et al., 2009). So not only are graduate students underrepresented in the literature, but there is an assumption that they have already gained the skills that they need.

Although there is a dearth of literature about differences between the digital literacy of graduate and undergraduate students, there is some literature about general educational differences between the two groups. While undergraduates typically learn foundational content in a broad curriculum, graduate students are often focused on higher-level content in a specific professional field (Seligman, 2012). The specificity of the education of graduate and professional students may exclude training or emphasis on digital literary skills, or operate under the premise that graduate level learners are already digitally literate. There is an assumption in higher education that graduate students develop skills by virtue of learning through required academic tasks and having proximity to other students and faculty (Hurst, Cleveland-Innes, Hawranik, & Gauvreau, 2013).

As undergraduate students transition to become graduate students, they develop to become more autonomous learners and are encouraged to pursue their studies under their own direction (Hussey & Smith, 2010). Also, and as to be expected, graduate students are reported to have engaged in deeper levels of critical thinking than undergraduates (Artino & Stephens, 2009). Since many frameworks and definitions of digital literacy integrate elements of critical thinking (Calvani, Fini, & Ranieri, 2010; Bawden, 2001; Cornell University, 2013; American Library Association, 1989), there also may be an assumption that graduate students are operating on higher cognitive levels than undergraduate students and thus may have more advanced digital literacy skills.

Research indicates that socioeconomic factors such as parental education, gender, and race affect the digital literacy of undergraduate students (Hargittai, 2010). In light of the differences in critical thinking, autonomy, and specificity of training, it is plausible that the socioeconomic factors that affect the digital literacy of undergraduates may affect the digital literacy of graduate students differently. Graduate students have characteristics that differ from undergraduate students, and due to these differences the effect of socioeconomic factors should be explored in more detail.

When discussing digital literacy, it is also important to take into account the role academic discipline plays in the identity and skills of graduate and professional students. Graduate and professional disciplinary communities have been described as tribes or territories because their unique cultures make their academic communities different from each other (Becher, 1989; Becher & Trowler, 2001). Differences between disciplines include research and publications, career paths, symbols of identity, and student training (Clark, 1999).

Biglan (1973) classified academic disciplines into three dimensions, pure vs. applied, hard vs. soft, and life vs. non-life. Pure disciplines are illustrated as being concerned with the building of theory (e.g. physics), while disciplines located on the applied dimension (e.g. medicine) are more concerned with applied theory. Hard dimension disciplines (e.g. dentistry) are characterized as having a single paradigm and are more likely to have consensus about methodology. This differs from soft dimension disciplines (e.g. marketing), which are characterized as less likely to have consensus about methodology and also as being non-paradigmatic. Last, life disciplines are concerned with life systems (e.g. social work) where non-life disciplines, such as law, are not.

Differences have been found among academic disciplines. Faculty in hard areas have been found to be very different from their soft-area colleagues when measuring social connectedness, commitment to teaching, and scholarly output (Biglan, 1973b). Weng and Ling (2007) found that some academic disciplines are more likely to use information and communication technology (ICT) due to the nature of their programs. Research cultures such as the pure, hard disciplines of science and health science are more likely to strategically incorporate the use of ICT into their fields (Fry, 2004), while soft disciplines in the social sciences are more likely to incorporate ICTs in an as needed and localized manner (Fry, 2006). In addition, further studies have found differences in academic discipline by technology acceptance (Orji, 2010) risk perception of technologies (Weisenfeld & Ott, 2010), and general use of technology (Guidry & BrekaLorenz, 2010). Each academic disciplinary community has its own unique identity, which influences how students are educated, trained, and socialized. Because of the unique academic disciplinary identity and characteristics of graduate students, academic discipline should not be ignored when striving to understand the digital literacy of graduate students.

1.2 Research Question and Specific Aim

There has been a call for research around the subject, emphasizing a need for more evidence to provide an accurate picture of how students are using and adopting technology (Bennett et al., 2008). In addition, a recent report from the UK's National Union of Students advises pursuing research into the specific ICT needs and characteristics of postgraduates and students over 30 (NUS, 2010). Although there is a growing body of literature about the digital literacy of undergraduate students, there has been little if any research completed on the population of graduate and professional students. To address this gap, this study hopes to

investigate how academic and socioeconomic factors affect the digital literacy of graduate and professional students. The study will be conducted at the University of Maryland, Baltimore (UMB) due to the availability of graduate and professional students enrolled in differing academic disciplines.

UMB was founded in 1807 and has had a rich history in Baltimore. Today, this 71-acre research and technology complex encompasses 65 buildings in West Baltimore near the Inner Harbor. UMB is Maryland's only public health, law, and human services university. Its seven professional and graduate schools train the majority of the state's physicians, nurses, dentists, lawyers, social workers, pharmacists, as well as a substantial number of the state's biomedical scientists (University of Maryland, Baltimore, 2015). The student body is comprised of 88 percent graduate and professional students, and in fall of 2014 enrolled 6,276 students.

The primary purpose of this research is to examine whether academic discipline is associated with web-use skills among the graduate and professional students at the University of Maryland, Baltimore. To the best of this author's knowledge, the effect of academic discipline on digital literacy has not yet been investigated in the literature. When applying Biglan's (1973) paradigm of academic disciplines matrix to UMB's graduate and professional schools, it is apparent that the schools fall in different dimensions. Medicine, Pharmacy, Dentistry, and Nursing are applied, hard, and life disciplines. Social Work is a pure, soft, life discipline, and Law is an applied, soft, and non-life discipline. Based off of this framework, the different disciplines at UMB may be associated with different uses of ICT and varying levels of digital literacy skills.

Table 1.1.1 Biglan's (1973) Matrix applied to UMB's Professional and Graduate Schools

	Hard		Soft	
Pure			Social Work	
Applied	Medicine Pharmacy Dentistry Nursing			Law
	Life	Non-life	Life	Non-life

The secondary purpose is to investigate how age, gender, race, parental education, international status, GPA, and self-perceived skills are associated with web-use skills. In literature, these demographics have been shown to be factors that influence digital literacy. The impact of these factors is addressed in depth during the literature review.

The intent of the study is to obtain data that will be used to improve programs and services addressing digital literacy and technology at the University of Maryland, Baltimore and to make recommendations for students, faculty, staff, and policy-makers. This study will contribute to existing research regarding digital literacy and by investigating a population whose digital literacy and web-use skills have not been explored.

The literature review that follows in the next chapter examines the current body of knowledge regarding digital literacy models, factors that affect digital literacy, and assessment of student learning. This background was necessary to understand what digital literacy is, how to measure it, and what socioeconomic factors affect it. The methodology in Chapter 3 describes the research methods, which includes an overview of the statistical analysis and the study procedures. The results of this study are documented in Chapter 4 and include descriptive statistics and a nonparametric analysis of the data collected. The discussion in Chapter 5 describes the study's limitations, examines its contributions to research, and discusses the implications of the results.

CHAPTER II

LITERATURE REVIEW

The purpose of this study is to determine whether academic discipline is associated with web-use skills among graduate and professional students at the University of Maryland, Baltimore. The overall goal is to use the results to be able to discuss the implications of the data for students, educators, administrators, and policy markers. It is important that students are capable users of technology because they live in a world where the impact of technology grows greater by the day. Technology is radically changing entire industries and professions. Where it once may have been acceptable to have a single skillset for employment, now flexibility is paramount. Students are being prepared for jobs that have not yet been created, and they need to be equipped with the cognitive skills and practical wherewithal to be successful in the intersection of uncertainty and opportunity. The key areas this literature review will be focusing on are:

- Digital literacy (Sections 2.1 – 2.6)
- Technology use and assessment (Sections 2.7 – 2.14)
- Factors that affect digital literacy (Sections 2.15 – 2.20)

2.1 Defining Digital

Digital literacy has many definitions and derivatives and it is necessary to clarify definitions and concepts that will be referenced through this study. The concept of “digital” is characterized by electronic and computerized technology (Merriam-Webster Definition, 2013).

More specifically, it refers to the shift that began when IBM launched the “Personal Computer” (PC) in 1981 and kick-started a consumer-friendly, home-computing revolution (Elliot, 2011).

In addition, it is also essential to note the pivotal role the development and growth the Internet plays into the concept of digital. The Internet allows people to connect in new ways and gives people access to incredible amounts of information. Internet capable mobile devices and tablets, which have been experiencing incredible growth in popularity, have further connected people and allow users to access information anywhere with Internet access. As of January 2014, 90 percent of American adults have a cell phone and 58 percent of American adults have smartphones. Also in 2014, 42 percent of American adults are reported to have a tablet computer and 32 percent have an e-reader (Mobile Technology Fact Sheet, 2014). Looking at the younger adult demographic, 97 percent of those between the ages of 18-29 have cell phones and 80 percent of those between 18-29 have smartphones (Brenner, 2013). This definition of digital concerns the ubiquitous nature of the PC, the Internet, and Internet-capable mobile devices and their integration into user’s everyday lives, workplaces, and educational settings.

Technology is changing college students’ day-to-day lives. Cultural transformations in recent years have been strongly linked to the developments of technology and have changed how students consume information (Buckingham & Willett, 2006). The introduction of technology “raises discussions about what it means to be able to ‘read’ and ‘write’” in a cultural sense and is “understood as interpretation of and access to information and how we communicate and express ourselves” (Erstad, 2008, p. 177-178).

2.2 Digital Literacy Origins

The concept of digital literacy was first introduced by Paul Gilster in 1997. Rather than list skills, competencies, or attitudes defining digital literacy, he defined it more conceptually as

a way to understand and to use information from a variety of digital sources and regarded it simply as literacy in the digital age. “Digital literacy is about mastering ideas, not keystrokes” (Gilster, 1997). Gilster’s definition of digital literacy is not about any particular technology but instead about “ideas and mindsets, within which particular skills and competencies operate” (Bawden, 2008, p. 19).

In recent years, there has been an interest in how traditional definitions of literacy has changed due to newer technologies. Extending the application of the term literacy is a common practice and the term is morphing into a “vague synonym for competence or even skill” (Buckingham, 2008, p. 75). Some scholars argue that literacy should only be defined as it relates to writing (Barton, 1994), while others argue that visual media requires a process of cultural learning (Messaris, 1994). Visocky O’Grady and Visocky O’Grady found that “in a knowledge economy, our understanding of the term "literacy" has expanded. It no longer simply refers to reading and writing skills, but also focuses on the ability to find, process, interpret, and apply information” (2008, p. 91).

There are many terms and definitions for digital literacy and related concepts. Cornell University’s Digital Literacy Resource defines digital literacy as the ability to “find, evaluate, utilize, share, and create content using information technologies and the Internet” (2013). Eshet-Alkalai (2004) calls digital literacy “survival skills in the digital era” comprised of five literacies including photo-visual literacy, reproduction literacy, information literacy, branching literacy, and social-emotional literacy. Another variation of digital literacy is Hargittai’s (2005) web-oriented digital literacy, or the measure of users’ actual knowledge of computer and Internet related terms and functions.

2.3 Information Literacy

Information literacy may be the most well known new literacy and is the base of many other definitions. Paul Zurkowski coined the term information literacy in 1974, but his definition was quite different than how the term is used today. Zurkowski associated information literacy with the effective use of information, specifically with problem solving in a commercial environment (Bawden, 2001). Burchinal (1976) gave a similar use of the term that also emphasized problem solving. There was criticism that this view didn't address any aspects of citizenship and could be broader than just having a work related focus (Bawden, 2001). More recently, information literacy has been defined as to "be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989). The term "information literacy" is now used largely, but not exclusively, by the library community.

2.4 Other Related Literacies

In addition to the many definitions of digital literacy, there are also other related terms that address similar topics, although many definitions possess nuances to distinguish themselves. Some of the more common terms include information literacy, information communication and technology (ICT) literacy, media literacy, communication literacy, visual literacy, network literacy, e-literacy, web literacy, and Internet literacy. A few of authors have tried to organize the concepts including Bawden (2001), and more recently Kope (2006). Table 2.4.1 lists and defines related literacies.

Due to the sheer number of definitions and somewhat confusing terminology, the development and use of the concept of digital literacy is often difficult to employ. Eshet-Alkalai (2004) suggests that the unclear use of the terms causes ambiguity and that leads to poor

communication and misunderstanding. Different naming conventions create different assumptions about what the terms means. Also, Eshet-Alkalai finds that there is a particular inconsistency between those who see digital literacy as operational, concerned with technical skills, and those who see it conceptually, or focused on cognitive and socio-emotional aspects of working in a digital environment (Eshet-Alkalai, 2004).

Table 2.4.1 Related Literacies

Terminology	Definition
Communication Literacy	Learners must be able to communicate effectively as individuals and work collaboratively in groups, using publishing technologies, the Internet, as well as other electronic and telecommunication tools (Martin, 2008).
Computer literacy	In vogue in the 1980s, computer literacy is being able to use software packages effectively (Martin, 2008).
Computer literacy	Computer literacy is to use technology as a tool for organization, communication, research, and problem solving (Eisenberg & Johnson, 2002).
Digital Competence	Digital Competence is to be able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations. (Calvani, Fini & Ranieri, 2009).
Digital literacy	Digital literacy is a way to understand and to use information from a variety of digital sources and is regarded simply as literacy in the digital age (Gilster, 1997).
Digital literacy (2)	Digital literacy is a survival skill in the digital era comprised of five other literacies including photo-visual literacy, reproduction literacy, information literacy, branching literacy, and social-emotional literacy (Eshet-Alkalai, 2004).
Digital literacy (3)	Digital literacy is comprised of the following tenants: <ul style="list-style-type: none"> • “Knowledge assembly,” building a “reliable information hoard” from diverse sources

- Retrieval skills, plus “critical thinking” for making informed judgments about retrieved information, with wariness about the validity and completeness of internet sources
- Reading and understand non-sequential and dynamic material
- Awareness of the value of traditional tools in conjunction with networked media
- Awareness of “people networks” as sources of advice and help
- Using filters and agents to manage incoming information
- Being comfortable with publishing and communicating information, as well as accessing it (Bawden, 2001).

Digital literacy (4)	Digital literacy is the ability to successfully navigate encounters with the electronic infrastructures and tools that make possible the world of the twenty-first century (Martin, 2005).
E-literacy (short for electronic literacy)	E-literacy combines traditional skills of computer literacy, aspects of information literacy, the ability to find, organize, and make use of digital information, and knowledge construction and expression (Martin, 2003, 2005) E-literacy is a much debated topic that may have been more widely adopted if not for the confusion with similar sounding illiteracy.
Information literacy	Used largely by the library community, information literacy is the basis for many other definitions of new literacy. To be information literate is to be able to: <ul style="list-style-type: none"> • Recognize a need for information • Identify what information is needed • Find the information • Evaluate the information • Organize the information • Use the information (American Library Association, 1989).
Information literacy (2)	Someone who is information literate is able to: <ul style="list-style-type: none"> • Engage in independent self-directed learning • Use information processes • Use a variety of information technologies and systems • Internalize values that promote information use • Have sound knowledge of the world of information • Approach information critically • Determine their own personal information style <p>Information literacy less as a series of competencies to be mastered and more as a set of general knowledge and attitudes to be possessed by an information literate person (Bruce, 1997).</p>

Literacy	<p>To be literate means the individual has the following seven components:</p> <ul style="list-style-type: none"> • Tool literacy – competence in using hardware and software tools • Resource literacy – understanding forms of, and access to, information resources • Social-structural literacy – understanding the production and social significance of information • Research literacy – using IT tools for research and scholarship • Publishing literacy – ability to communicate and publish information • Emerging technologies literacy – understanding of new developments in IT • Critical literacy – ability to evaluate the benefits of new technologies (Shapiro & Hughes, 1996).
Network literacy	Network literacy focuses on digital information in networked form (McClure, 1994).
Informancy	Informancy implies traditional literacy, plus information literacy (Neelameghan, 1995).
Information Communication Technology (ICT) literacy	ICT literacy is using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society. The definition reflects the concept of ICT literacy as a continuum, which allows the measurement of various aspects of literacy, from daily life skills to the transformative benefits of ICT proficiency (International ICT Literacy Panel, 2002).
Internet literacy	Internet literacy is the capability to access and evaluate online information (Eisenberg & Johnson, 2002).
Internet literacy (2)	Internet literacy is online search competence (Harkham Semas, 2002).
Internet literacy (3)	Internet literacy is having skills with connectivity, security, communication, multimedia, and web page development (Hofstetter, 2003).
Multimedia literacy	Since a digital source could generate many forms of information (text, images, sounds, etc) a new definition of literacy was necessary to make sense of these new forms of presentation. Lanham coined the term multimedia literacy to address this new literacy (Lanham, 1995).
Media Literacy	Media literacy is represented by four broad concepts, 1) representation, 2) language, 3) production, and 4) audience (Buckingham, 2003).

Media Literacy	Media literacy attempts to consolidate strands from the communication multi-literacies that correspond with the convergence of text, sound and image. It has been associated with the ability to make sense of all media and genre, from the more classic education fare to popular culture (Tyner, 1998).
Mediacy	Mediacy is the ability to deal with digital information in a variety of media (Inoue, Naito & Koshizuka, 1997).
Technology literacy	Technology literacy is an individual's abilities to adopt, adapt, invent, and evaluate technology to positively affect his or her life, community, and environment (Hansen, 2005).
Visual literacy	Visual literacy refers to a group of vision-competences a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, symbols, natural or man-made, that he encounters in his environment (Debes, 1969).
Web-oriented digital literacy	Web-oriented digital literacy is the measure of users actual knowledge of computer and Internet-related terms and functions (Hargiatti & Hsieh, 2012).

Lankshear and Knobel distinguished between conceptual definitions of digital literacy from standardized operational definitions (2006). Conceptual definitions view digital literacy as a general idea or an ideal. In contrast, standardized operational definitions “operationalize” digital literacy in terms of certain tasks, performances, demonstrations of skills, etc. and advance these as a standard for general adoption (Lankshear & Knobel, 2008).

Some of the terms, such as computer literacy, e-literacy, network literacy, and informancy have been outgrown. The terms used most frequently in the literature about new literacies are digital literacy and information literacy. A main differentiator for those terms still in use is the difference between whether the term has an operational or conceptual definition. Purely operational definitions are quickly dated, because as technology changes the definition

becomes irrelevant. For example, computer literacy is being able to use software packages effectively. Given the variety of software that now exists—from Microsoft Excel to the Adobe Creative Suite—it is unrealistic to expect someone to be able to use them all. It is not as important to be able to use all software packages, but instead it is more important for students to be able select and use the ones that are applicable to their lives.

The terms and definitions that will live on will are likely to be conceptual terms that employ a cognitive dimension. The hardware and interfaces of technology will change over time. The most important ability to have will not be learning a specific set skill, but instead to be able to conceptually navigate those changes over time. Digital is not an end, but instead a means to an end. It transforms the way people gather information and interact with the world. Successfully literate people will be equipped to evolve with the technology around them.

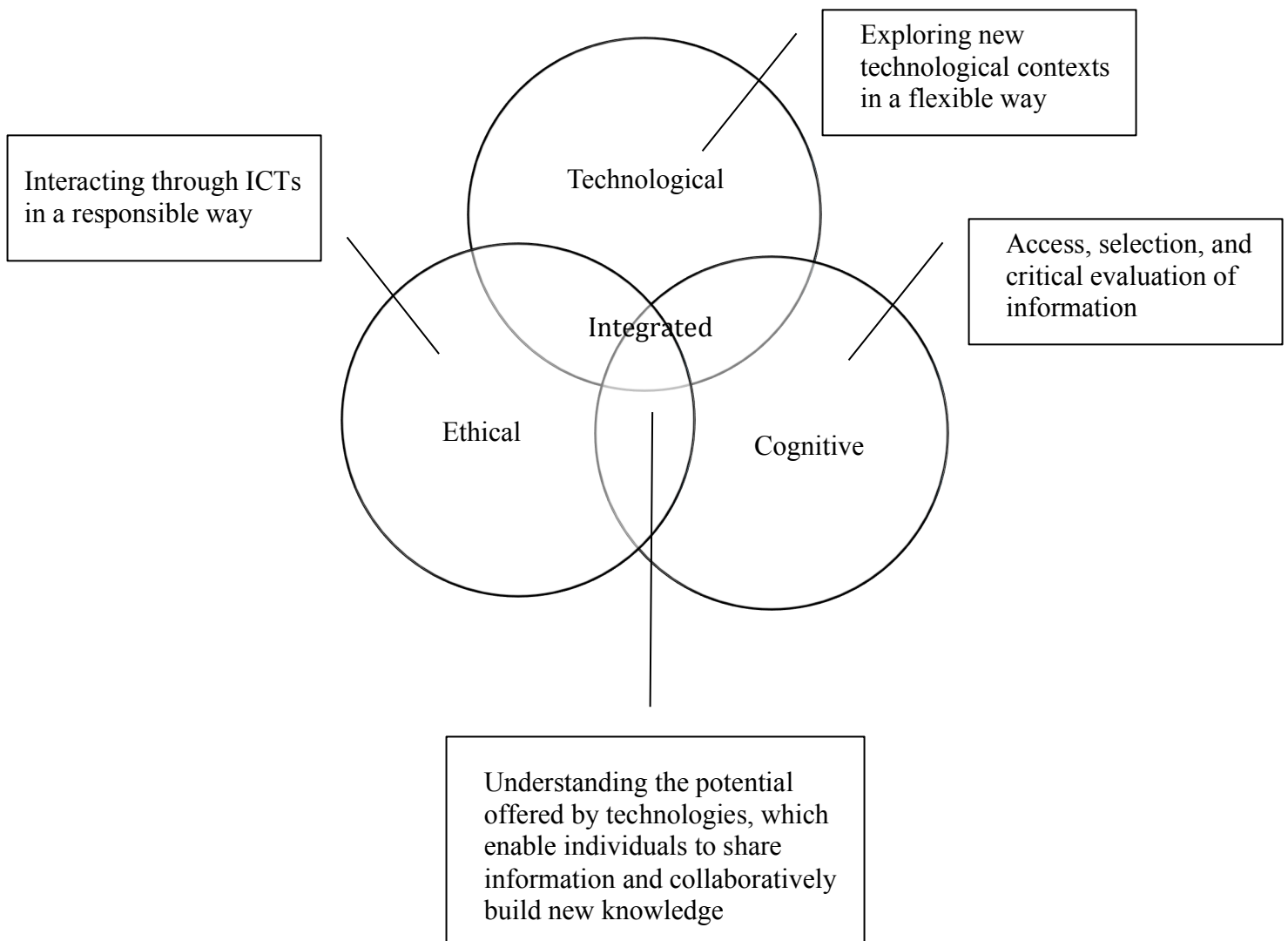
2.5 Conceptual Frameworks for Digital Literacy

Due to the constant nature of changes in technology, the trend of the definition of digital literacy has evolved to a more conceptual definition, rather than focusing on technical operational requirements. There are only a few frameworks for digital and related literacies, and most of them have elements of higher levels of cognition. Calvani et al. (2010) created a widely used framework that embraces the concept that digital competence is “not the results of simple elements of ability or instrumental knowledge, but rather a complex integration between cognitive processes and dimensions as well as methodological and ethical awareness.”

Calvani et al. (2010) define digital competence as “being able to explore and face new technology situations in a flexible way, to analyze select, and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and

build shared and collaborative knowledge, while fostering awareness of one's own personal responsibilities and the respect of reciprocal rights/obligations" (See Chart 2.5.1).

Chart 2.5.1 Digital Competence Framework (Calvani et al., 2010)



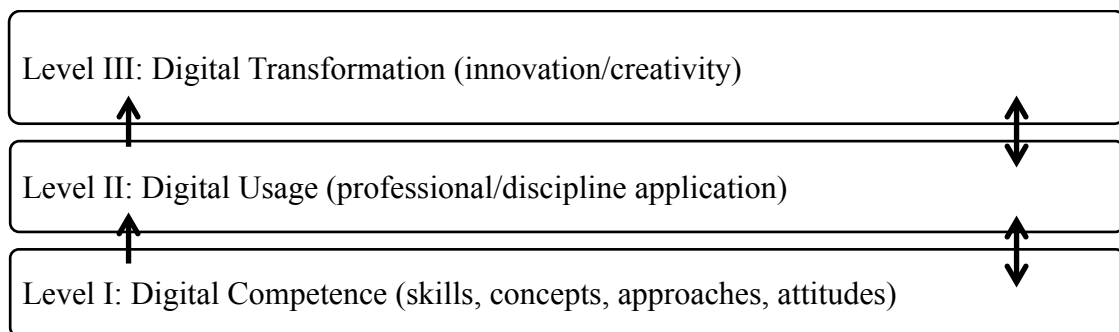
The framework is comprised of three coexisting and integrated dimensions; technological, cognitive, and ethical.

- technological dimension: being able to explore and face problems and new technological contexts in a flexible way;
- cognitive dimension: being able to read, select, interpret and evaluate data and information taking into account their pertinence and reliability;
- ethical dimension: being able to interact with other individuals constructively and with sense of responsibility using available technologies;
- Integration between the three dimensions: understanding the potential offered by technologies which enable individuals to share information and collaboratively build new knowledge (Calvani et al., 2010).

One of the premises of this model is that individuals are constantly facing new tools and applications as a requirement of contemporary society. This framework emphasizes that individuals need to be flexible and able to adapt to new technologies and use their pre-existing knowledge to face and master the unknown (Calvani et al., 2010). What this model has that many others do not is the element of the ethical dimension of technology use. This is particularly important due to the rise of ethical issues such as plagiarism or cyberbullying in higher education. Cyberbullying, for example, can be worse than traditional bullying as there is an increased potential for a larger audience and anonymity, and lower levels of direct feedback and supervision (Sticca & Perren, 2012). It is important that individuals are made aware and educated on the impact of their technology use and this is why the ethical component is an important dimension.

Another model is Levels of Digital Literacy developed by Mayes and Fowler (2006). This framework approaches digital literacy on three levels. First is digital competence, which consists of learning basic skills and techniques. The second level is digital usage, or using and applying the concepts. Last is digital transformation, which is when the individual has mastered the usage and is able to use the tools for innovation.

Chart 2.5.2 Levels of Digital Literacy (Mayes & Fowler, 2006)



It is interesting to look at this framework in the lens of how information is consumed on electronic devices. Many of the popular devices today are designed to consume information rather than create information (personal communication, S. Carton, Feb. 2014). For example, an iPad is great for reading, or to use apps to navigate tasks such as online banking, but it lacks some of the more powerful capabilities of creation. An iPad can be difficult to write at length on, at least without a keyboard. It doesn't have the memory for powerful statistical software or design applications. The iPad is better suited for transactions and the consumption of information than the creation of new things.

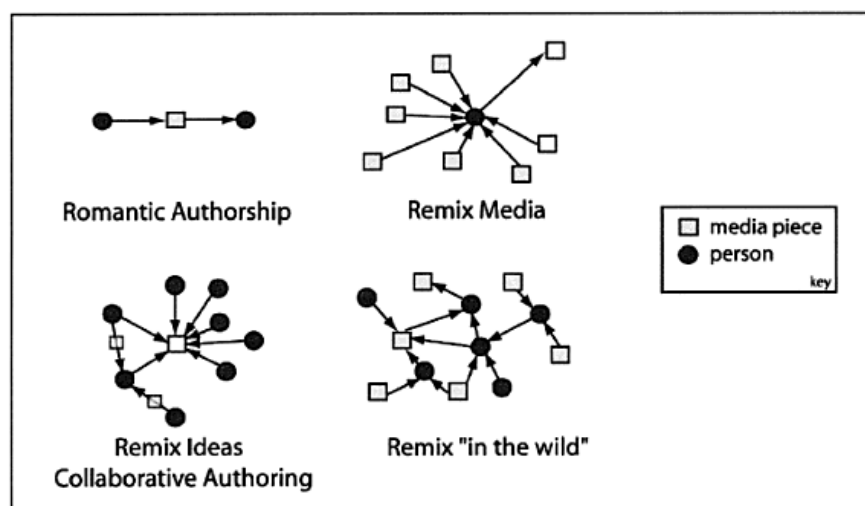
If you applied this line of thought to Mayes and Fowler's (2006) model of Levels of Digital Literacy, the user would hover at levels 1 and 2, but wouldn't necessarily progress to

level 3. When a user is using a tool to consume information rather than create, they are not challenged to master the tools or use them for innovation and creativity.

2.6 Collaboration and Culture

Digital tools create new platforms for creativity. New literacies are seen as “more collaborative,” “participatory,” “more distributed”, and “less individuated” by Lankshear and Knobel (2006). Collaborative authorship relies on the input of multiple people and can be organized or organic. Lorenzo, Dziuban, and Oblinger observed that students are not just consuming information, but instead are taking existing material, adding or removing elements, and then republishing. These derivative works bypass traditional methods of production and publication (2007). Individuals are able to use online tools to “remix” information in ways that have never been done before. The term “digital remixing” has been coined to describe how individuals are using digital tools to create new possibilities for getting access to information, producing, sharing, and reusing (See Chart 2.6.1).

Chart 2.6.1 Graphical Representation of Different Modes of Remix (Diakpolous, 2005)



Depending on what is being remixed, there are often fewer financial barriers to entry and information can be shared widely and quickly through self-authorship platforms such as YouTube or WordPress. What's unique about digital remixing is that a diverse group of the population can take part in digital remixing, not just the elite or specific technical groups. Although many people are online creating and remixing content, it should be noted that in the United States those that create content make up only 23 percent of the online adult population (Li & Bernoff, 2008). This again goes back to the idea of creation vs. consumption – more people are consuming than creating information online.

Others view literacy through the lens of culture. Lankshear and Knobel (2008) see literacy as “socially recognized ways of generating, communicating, and negotiating meaningful content as members of discourses through the medium of encoded text” (p. 249). Scribner and Cole (1981) call literacy a social practice used for developing social and patterned ways of using technology to accomplish goals. Literacy is similar to a family of socially evolved and patterned activities such as letter writing, keeping records and inventories, keeping a diary, posting announcements, etc. (Knobel & Lankshear, 2008).

Many contemporary popular cultural pursuits involve highly technical and specialist styles of language (Shaffer & Gee, 2005). People of all ages are engaging with “digital artifacts.” Surrounding these artifacts are complex vocabularies in order to understand the rules of video games or to master concepts for operating specific software or technologies (Lankshear & Knobel, 2008). Twitter is a good example of this because users have their own vocabulary (tweet, hashtag) and ways of interacting when using their platform (mentions).

Scribner and Cole (1981) found that literacies change over time due to social-cultural processes and McGarry (1993) observed that literacy is a relative concept. “To be literate in

Honduras is not the same as to be literate in Hampstead, London” (Bawden, 2001). The continuum ranges from being able to read and write to logical thinking, higher order cognitive skills, and reasoning. “For most of the last centuries that the term has been in use, it has meant being well educated, well-read, versed in literature and letters” (Bawden, 2001). Barton and Hamilton define literacy as “something people do; it is an activity located in the space between thought and text” (1998, p. 3). Being literate therefore involves an understanding not just of how to read and write, but also involves awareness of ‘social stuff’ that surrounds text (Davies, 2008).

If digital literacy is viewed through the lens of culture and ‘social stuff’ it can be compared to a type social capital. Social capital has the potential to increase one’s sense of community, grant access to information and knowledge, and provide status and recognition (Bohn, Buchta, Hornik, & Mair, 2014). Not having the skillset to or the cognitive mental model to use technology could potentially impair an individuals’ ability to connect with others in addition to impeding their access to information.

2.7 Student Use of Technology

Internet capable mobile devices are growing in popularity with 89 percent of students owning smartphones in 2014 (Pearson Student Mobile Device Survey, 2014), up from 66 percent in 2010 (Smith, Salaway, & Caruso, 2010). Ownership of computers by students has remained steady at 98 percent between 2006 and 2009 (Smith et al., 2010) although there was a drop in the number of desktop users and a rapid rise in laptop ownership. Seven out of ten students own a computer newer than two years old and laptops are still the most commonly used mobile device for academic use (Smith et al., 2010). Nearly 45 percent of college students report that they regularly use a tablet in 2014, up from 40 percent in 2013. Although tablet use is lower than

smartphone and laptop use, 81 percent of students think that tablets will transform the way college students learn in the future (Pearson Student Mobile Device Survey, 2014).

In addition to what technologies students are using, it is important to understand how students use technology. In 2002, the Pew Internet and American Life Project (PEW) began collecting data about college students' use of Internet and computer technologies, specifically how they accessed information and communicated with friends and fellow students (Jones, Ramanau, Cross, & Healing, 2010). Data was collected using large surveys from two and four-year institutions at 27 U.S. colleges and universities, ethnographic observations of life in Chicago area institutions, and PEW survey findings of American's use of the Internet in 2001 and 2002. They found college students were engaged in more online activities than the average adult, such as music downloading, file sharing, instant messaging, and online chatting (Jones et al., 2010).

Since 2004, the ECAR Study of Undergraduate Students and Information Technology has sought to discover how university students use technology for both academic and non-academic use (Smith et al., 2010). The 2010 report suggest that undergraduates may become leaders among the early users of cloud computing as almost three-quarters of the 36,950 students reported using at least one web-based tool for a course in the spring 2010. In addition, Kennedy et al. (2007) surveyed 2,588 first-year students at several Australian universities. They investigated how students used 41 different applications of new technologies in their academic and personal lives. Searching for information on the web, email, use of a mobile device, and text messaging were used very frequently by a large majority of students (Kennedy et al., 2007).

Students are using technology in different ways in academic and non-academic contexts. Outside of school, students are using email, social media, texting and talking on cell phones, and

instant messaging (Corrin et al. 2010). Communication technologies dominate students' use of technological tools with 95 percent of students using text messaging in 2010, remaining consistent over the past four years (Smith et al., 2010). When using technology for academic study, regular use of social networking and IMing for communication was much lower than mobile phone and email communication (Corrin, et al., 2010). In addition, writing a blog, building websites and using RSS feeds are not frequently used, and a majority of students reported having never completed these activities (Corrin, et al., 2010).

In addition, Corrin et al. found that the frequency of use of technology for academic activities is lower than everyday life for the students in the study (2010). "It is unclear if this is caused by a lack of integration of technology into teaching or if students are not motivated to use technology to support their learning" (Corrin et al. 2010, p. 649). Selwyn also noted that although there has been considerable growth in access to technological tools, students' use of technology is often used for "social and entertainment purposes, but not for learning" (2009).

So how are students using technology for in their educational experience? More than 94 percent of students reported using their universities' website for school, work, and recreation, and 90 percent of students were using the course or learning management systems (Smith et al., 2010). In school, students are accessing information on the Internet, using email, word processing, math and science based programs, texting on cell phones, and accessing electronic databases. In addition, students are using technology to collect, select and work with information (Corrin et al. 2010).

Technology use by students in an academic context changes the roles of participants, time, content and social organizations. Students are becoming active rather than passive learners, and faculty are serving more as a "guide on the side" rather than a "sage on the stage" (Gumport

& Chun, 1999). Technology also changes the dimension of time as students can use software and applications at their own pace and at convenient times of their choice (Gumport & Chun, 1999). In addition, technology affects the social organization of teaching and learning by expanding the delivery of higher education. No longer do students have to be physically present in a classroom to be part of the educational experience.

Some students feel there is a place for all technologies in an educational form, while others want to maintain a separate digital footprint for inside the classroom (Clark et al., 2009). The term digital dissonance has been introduced to describe “the tension with respect to learners’ appropriation of Web 2.0 technologies in formal contexts” (Clark et al., 2009, p. 57). “This element of dissonance is framed by a situation where young people’s ‘everyday’ use of digital technologies is encountering a process of delegitimization as evidenced by the banning of mobile phone use in schools, for example” (Clark et al., 2009, p. 57).

2.8 Technology and Educational Reform

With the widespread use of technology both in and out of the classroom, there has been a spirited discussion on how use of technology impacts students’ ability to learn and professors’ ability to teach. Policy makers and educational change advocates claim that the current system of education is not equipped to accommodate the changing needs of the student population and call for “wide-spread discussion” about the trends (Dede, 2005, p. 15). Universities and higher education as a whole have been urged by some to make “strategic investments in physical plant, technical infrastructure, and professional development” to gain an advantage in both recruiting and teaching students (Dede, 2005, p. 15). Students are said to be a force for change, demanding new kinds teaching and learning and systems of delivery that are not currently being offered by universities (Jones, et al., 2011). In addition, Prensky (2001) claimed most teachers lack the

technological fluency of the digital natives. The disparity between the technological skills and interests of new students and the limited and unsophisticated technology use by educators is claimed to be creating alienation and disaffection among students (Levin & Arafeh, 2002).

Kennedy, Judd, Churchward, Gray, and Krause (2008) found that “the widespread revision of curricula to accommodate the so-called digital natives does not seem warranted,” (p. 10) and “we cannot assume that being a member of the Net Generation is synonymous with knowing how to employ technology strategically to optimize learning experiences in university settings” (p. 10). Jones and Cross, (2009) found that “it does not seem that [students] are marked by their exposure to digital technologies from an early age in ways that make them a single and coherent group.” In addition, they warn administrators and policy makers “against adopting technological determinist arguments that suggest that universities simply have to adapt to a changing student population who are described as a single group with definite and known characteristics” (Jones & Cross, 2009, p. 19).

Margaryan, Littlejohn, and Vojt (2011) completed a mixed method study in which they gave 160 students a questionnaire and conducted in-depth interviews with eight students and eight faculty and staff. The researchers asked the participants questions regarding their background, demographic information, use of technology in the course, technology used for learning, and technology use for socializing and recreation. Their findings show that regardless of age, students’ attitudes towards learning appear to be influenced by how the teachers lead the class (2011, p. 438). In addition, their study found no evidence that the “current generation of students adopt radically new learning styles, exhibit new forms of literacies, use digital technologies in sophisticated ways or have novel expectations from higher education” (2011, p.

438). The results of this study found that instead of having radically different expectations, students expected traditional ways of learning and teaching (Margaryan et al., 2011).

In 2011 Jones and Shao completed a comprehensive literature review, studying the relationship between digital natives and higher education. After reviewing the literature they found:

There is no obvious or consistent demand from students for changes to pedagogy at university... There may be good reasons why teachers and universities wish to revise their approaches to teaching and learning, or may wish to introduce new ways of working. Students will respond positively to changes in teaching and learning strategies that are well conceived, well explained, and properly embedded in courses and degree programmes (sic). However there is no evidence of a pent-up demand amongst students for changes in pedagogy or of a demand for greater collaboration (Jones & Shao, 2011, p. 2).

In addition, they reported this regarding the technology skill gap between students and their professors:

The gap between students and their teachers is not fixed, nor is the gulf so large that it cannot be bridged. In many ways the relationship is determined by the requirements teachers place upon their students to make use of new technologies and the way teachers integrate new technologies in their courses. There is little evidence that students enter university with demands for new technologies that teachers and universities cannot meet (Jones & Shao 2011, p. 1).

The evidence for the generational educational reform argument parallels the lack of empirical evidence regarding digital native claims referenced in the introduction. Some

proponents of the digital natives debate have begun to move away from age as the main criteria for membership and now are advocating usage levels and experience with technology as measures of whether a person can be considered a digital native, rather than their age alone (Dede, 2005; Bullen, Morgan, Belfer, & Qayyum, 2009). Although this proposition appears to make more sense because it acknowledges that people of any age can develop technological expertise, it still assumes a simple homogeneous notion of technological expertise.

This is also an interesting argument in the context of pedagogy and technology. Technology does not negate the importance of good teaching and instruction, and merely having more technology does not enhance a students' ability to learn. Technology supports the goals of teaching, but is not a substitute for it. In light of the discussion on education reform, this is not an argument that educators cannot learn from students or education should not change to meet changing demands. Instead, change should spring from systematic evaluation and assessment of the education process.

2.9 How Digital Literacy is Measured and Assessed

In light of the claims of digital natives being inherently digitally literate, there is evidence suggesting students are struggling with current technology used by universities. "Despite coming of age with the Internet and other technology, many college students lack the information and communication technology (ICT) literacy skills necessary to navigate, evaluate, and use the overabundance of information available today" (Katz, 2007). There is increasing evidence that students do not use technology effectively when they conduct research or communicate (Rockman, 2002). Universities are banding together to study and promote digital literacy. The National Higher Education ICT Literacy Initiative, a consortium of universities, was founded in 2003 (Katz, 2007). The consortium created a nationally available assessment of ICT literacy for

students and tested over 10,000 students in 2005 and 2006. The consortium found evidence of students' difficulty with ICT literacy and found that students scored poorly – achieving only about half the possible points on the assessment (Katz, 2007). As more universities develop information literacy instruction, more effective assessment tools will need to be developed to measure students' digital, information, and communication technology skills (Katz, 2007).

When assessing digital literacy, most of the existing research is found by participants self-reporting their skill levels (van Dijk, 2006), often referred to as self-efficacy (Bandura, 1977). This is an indirect measure as opposed to a direct measure that assesses users' actual knowledge of digital literacy. There are a few existing instruments that measure digital literacy including Educational Testing Service's (ETS) iSkills, Hargittai's Web-Use Skills Index (2005), and the Digital Competency Assessment (DCA) although none are recognized as a standard of measurement.

ETS was founded in 1947 and is the world's largest private nonprofit educational testing and assessment organization. The iSkills assessment from ETS is an outcomes-based assessment that measures students' ability to think critically in a digital environment. iSkills is a one-hour exam that features scenario-based tasks that measure students' ability to:

- Evaluate the usefulness and sufficiency of information for a specific purpose
- Create, generate or adapt information to express and support a point
- Communicate information to a particular audience or in a different medium
- Define an information problem or formulate a research statement
- Access, summarize and integrate information from a variety of digital sources (Educational Testing Service, 2014).

ETS is most often used to satisfy regional accreditation requirements and to measure student performance. The starting cost to administer the test is \$20 per student and the test can be

proctored on or off-campus. The results can be delivered in an individual or group format designed to demonstrate program effectiveness, enhance and develop curriculum, and evaluate students to make placement decisions (Educational Testing Service, 2014). The iSkills assessment has been used on undergraduate students and adult learners, but has never been used on graduate students (I. Katz, personal communication, April 30, 2014).

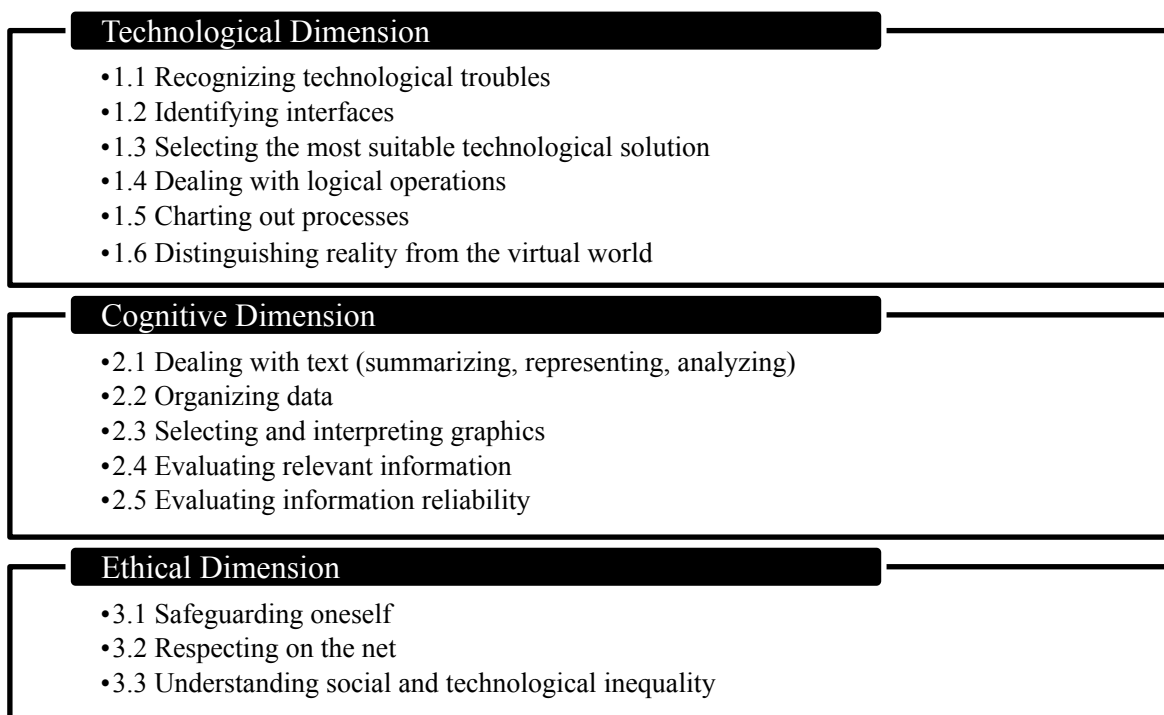
The web-use skills index is a survey developed by Ezter Hargittai in 2005 to serve as a proxy for observed skill measures, which are often expensive and difficult to collect for larger samples of participants. The survey was based on a study that examined users' digital literacy through both observations and survey. The analysis of the study yielded recommendations for what measures can be used as a survey proxy of participants' observed web-use skills (Hargittai, 2005). The observations that Hargittai (2005) conducted measured the effectiveness and efficiency of eight tasks. Participants looked for information on 1) job and career opportunities; 2) a site that compares different presidential candidates' views on abortion; 3) a used car for purchasing; 4) tax forms; 5) information about local cultural events (movie time listings, theatre shows); 6) music to listen to online; 7) children's art; and 8) museum's or gallery's website.

In addition to the direct observations of the searching for content online, participants were also presented with survey questions to measure aspects of their Internet-related knowledge. Hargittai (2005) collected four different types of measures a) four yes or no self-report questions about digital literacy b) 38 five-point (self-reported) ratings of degree of understanding of digital literacy-related items c) 37 multiple choice tests of digital literacy, and d) an overall (self-report) rating of Internet skill. Hargittai then completed descriptive statistics and an OLS regression and found that the relationship between outcome and skill measures was statistically significant. Due to organizing her instrument into four constructs, her findings

suggest that the self-reported ratings on the survey may be used as a proxy for actual skill. She has replicated use of the survey several times since then with different populations (Hargittai & Hsieh, 2012; Hargittai, 2009).

The Instant Digital Competency Assessment (DCA) was developed by Calvani, Cartelli, & Fini (2009) and is a wide-ranging instrument that covers linguistic and conceptual skills. The assessment contains 85 questions that include multiple choice, matching, and short answers. This assessment is based off of Calvani's digital competency framework covered earlier in Section 2.5. The three dimensions; technological, cognitive, and ethical, are broken down into further classifications in Chart 2.9.1. The instrument has been primarily used for 15 and 16 year-olds in Italian and English speaking schools, and there have been no studies that delve into their statistical reliability of the instrument (Calvani et al., 2009). The instrument is no longer available for public use.

Chart 2.9.1 Instant DCA Map of Skills (Calvani et al. 2009, p. 190)



2.10 Assessment and Learning Styles

To have a deeper understanding of how students' develop digital literacy, it is important to review learning styles and how they influence the learning process. Learning style advocates Vincent and Ross (2001) conclude that most educators “agree that learning styles exist and acknowledge the significant effect that learning styles have on the learning process” and there are many validating studies. Swanson’s (1995) review of literature found numerous studies identifying cultural differences in learning styles. Learning styles are defined in many ways but one of the most referenced definitions is how “cognitive, affective, and physiological factors affect how learners perceive, interact with and respond to the learning environments” (Keefe, 1997). Recent literature details the varieties of learning styles that students can exhibit and much of the work has its foundations in one of six models. See Table 2.10.1 to view an overview of learning style models.

Table 2.10.1 Learning Style Models Overview

Models of Learning Styles

Field dependence/field independence

Field dependence/independence measures the degree to which an individual uses “an analytical as opposed to a global way of experiencing the environment” (Keefe, 1997, p.9). Field dependence/independence is the study of the differences in how people perceive discrete items within a surrounding field (Witkin et al., 1977).

Jungian models (Myers-Briggs Type Indicator, Gregorc Style Delineator, Keirsey Temperament)

The Myers Briggs Type Indicator MBTI is a questionnaire measuring how people perceive the world and make decisions. This is based off of Jung’s proposed existence of four dichotomies cognitive functions – rational functions of thinking and feeling, and irrational functions of sensation and intuition. The test places individuals into one of sixteen types (Myers, 1962).

Gregorc breaks learners into four style types: concrete sequential (CS), abstract sequential (AS), abstract random (AR) and concrete random (CR). The four styles describe the characteristics of each type of learner based on how they like to process information and their learning preferences (Gregorc, 1982).

The Keirsey Temperament Sorter II is a 70-question personality instrument that rates people in four groups based off their MBTI category – Artisan, Guardian, Rational, and Idealist (Keirsey.com, 2014).

Sensory models (visual-auditory-read/write-kinesthetic - VARK)

The VARK learning style has four main ways of learning – visual, auditory, read/write, and kinesthetic (movement). Learners can use all four modalities to learn, however, according to the VARK theory, one or two of the styles is typically dominant. The dominant style is the best way for a person to learn (Flemming, 2009).

Social interaction models (Grasha-Riechman Student Learning Style Scales)

The Grasha-Reichman Learning Style Scale was developed in 1974 to determine college students' style of classroom participation. The scale focuses on students' attitudes towards learning, classroom activities, teachers, and peers. There are six styles in this model – avoidant, participative, competitive, collaborative, dependent, and independent (Grasha & Reichman, 1974).

Multiple intelligences model

Gardner identified seven distinct intelligences – visual-spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, linguistic, and logical mathematical (Gardner, 1983).

John Biggs' approaches to learning model (Study Process Questionnaire)

Biggs' theory is that a student's approach to learning has two components: 1) how the student approaches the task (strategy), and 2) why the student wants to approach it (motive) (Biggs, 1987).

The domains of learning styles each inhabit different aspects of an individual's learning preferences or orientations. As an overview, field dependence/independence indicates whether an individual prefers more concrete vs. abstract learning experiences (Keefe, 1979), while Jungian models are indicators of personality or temperament and categorize people how people perceive the world and make decisions (Myers, 1995). Sensory models are different modalities of how individuals physically interact with learning via their senses (Flemming, 2009), which differ from the social interaction model that highlights the differences in students' attitudes towards learning (Grasha-Riechman, 1974). Last, the multiple intelligences model identifies seven distinct intelligences that are innate to the learner (Gardner, 1983), and the approach to learning model identifies the learner's strategy and motive (Biggs, 1987).

When analyzing these learning styles, the ones that appear the most similar are the Jungian model, sensory model, and multiple intelligences model. These three speak to an innate

disposition that categorizes the learners into groups with different orientations towards learning. The approaches to learning and the social interaction models both deal with the learners' cognitive disposition towards learning as they study attitudes, motivation, and strategy. The model that is least similar to the others is the field dependence/independence model, which is an orientation towards wanting concrete or abstract learning experiences. Field dependent learners are more oriented to social learning in groups and applying learning to their own experience. This differs from field independent that is more likely to create their own structure and pursues ideas for their own sake.

The learning style models do not compete with one another, but instead identify multiple orientations that learners can have towards learning. Critics of learning style theory point out that for the theory to be valid and useful "it must be shown that students learn more effectively when their learning styles are accommodated, and only a limited number of studies have shown this" (MSCHE, 2007, p. 93). These tools may help "students gain self-awareness, provided that students have the opportunity to complete several instruments, so they do not take the results of any one instrument too seriously" (MSCHE, 2007, p. 94). Another concern is that most learning style theories lump and label students into categories rather than recognize that they exhibit a variety of styles and run the risk of stereotyping cultural groups (Stellwagen, 2001).

If using Calvani's framework of Digital Competence, the most useful learning styles would likely be Biggs' Approaches to Learning Model (1987). There are many different ways to learn and different orientations, but an interesting aspect of Biggs' approach is that it reviews how the student approaches the task, and why the student wants to approach it. Being digitally literate is not just about technical skills, but also how students conceptually view technological tools. Technology will change, and to be successful students need to be cognizant of how they

are approaching the task, and why they are approaching the task. Being able to strategically evaluate the problem and select the right technology for their situation is crucial for success in a changing world.

2.11 Assessment in Higher Education

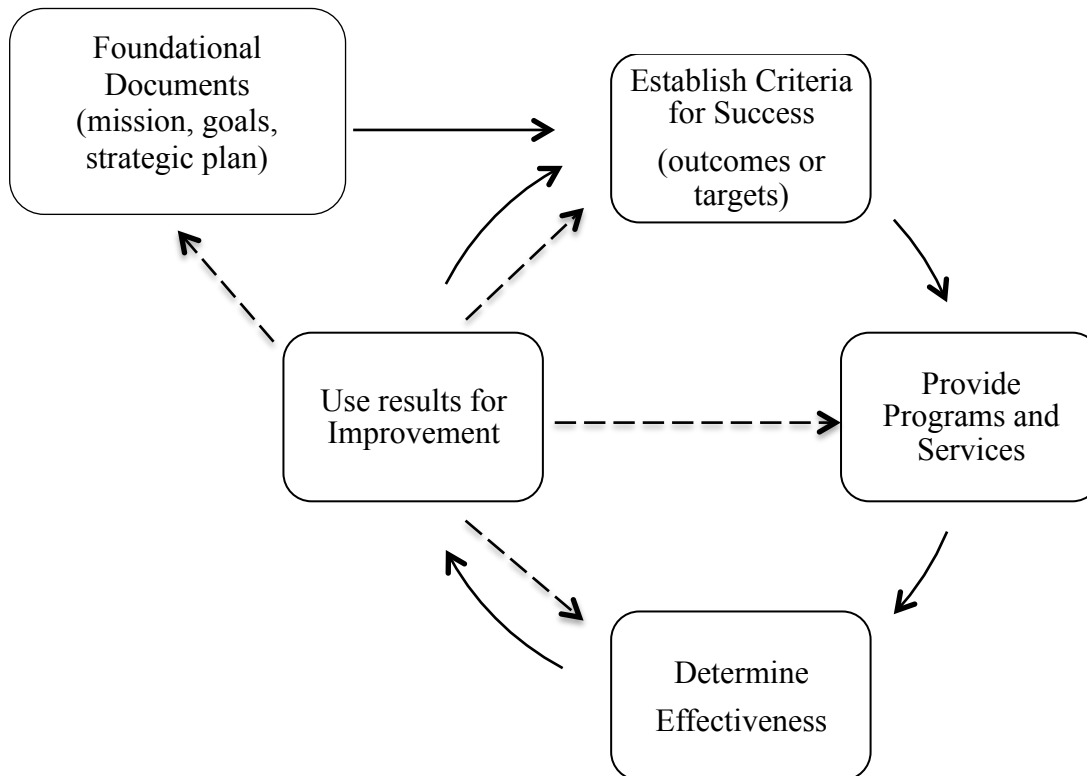
Assessment is a hot topic at higher education institutions. Depending on your stake in the university, assessment means different things. It is discussed as a measure of student learning, cost-effectiveness, administrative efficiency, and also measuring educational value (Spurlin, 2006). We also cannot forget assessment is used to help meet the demands of accreditation, for administrative needs, or to determine how well students learn in brick-in-mortar as compared to online courses (Spurlin, 2006). Some reasons for assessment are to “improve the quality of education; to aid in decision making, or to meet external agencies’ criteria (accountability)” (Spurlin, 2006).

Palomba and Banta define assessment as “the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving student learning and development” (1999). “The aims of assessment are typically broader than simply gathering direct evidence of student learning outcomes... assessment also embraces the processes used by institutions and programs to apply what they learn to make improvements in teaching and learning” (CHEA, 2003). Accountability is often linked with assessment, especially when the audience includes the public, state legislatures or accrediting agencies (Spurlin, 2006).

Assessment is a cyclical process that involves developing the question or outcome, defining methods, implementing assessment methods, analyzing data, interpreting the results, and making decisions based on the results and interpretations (Spurlin, 2006). It is also recommended that before the cycle is started it is important for those conducting the assessment

to determine their purpose by defining their organizational mission and goals (Campus Labs, 2014).

Chart 2.11.1 Assessment Cycle (Campus Labs, 2014)



There are many different methods to use to approach assessment including direct vs. indirect, formative vs. summative, quantitative vs. qualitative, and population vs. sample. Direct methods are any process employed to gather data that requires subjects to display their knowledge, behavior, or thought processes. Indirect methods ask subjects to reflect upon their knowledge behaviors, or thought processes (Campus Labs, 2014). Direct methods assess student work, projects, or portfolios developed from the learning experiences, while indirect methods use the opinions of students or others to indicate student ability (Spurlin, 2006). Some examples of direct assessment methods are tests, essays, homework, presentations, projects, thesis or dissertation work, and qualifying exams. Some indirect methods include surveys and inventories

related to behavior or attitude changes, focus groups meetings, student development transcripts, and student reflection on work, portfolios, and other activities (Spurlin, 2006).

Direct methods “provide evidence of whether or not a student has command of a specific subject or content area, can perform a certain task, exhibits a particular skill, demonstrates a certain quality in his or her work... or holds a particular value” (MSCHE, 2007, p. 30). Indirect methods are “related to the act of learning, such as factors that predict or mediate learning or perceptions about learning but not reflect learning itself” and are “often acquired through the use of self-reported format surveys, questionnaires, and interviews” (MSCHE, 2007, p. 32). Rubrics or rating scales, checklists, self-reflection, ratings from supervisors, tests, surveys, focus groups, portfolios, and retention/graduation rates are all tools for assessment (MSCHE, 2007).

Formative assessment is an “ongoing assessment,” or assessment conducted during the program. It is intended to “improve an individual student’s performance, student learning outcomes at the course or program level, or overall institutional effectiveness” (MSCHE, 2007, p. 27). Ideally, formative assessment allows the one conducting the assessment to “act quickly to adjust the contents or approach of a course or program” (MSCHE, 2007, p. 27). This differs from summative assessment which occurs at the end of a unit, course, or program. The purpose of summative assessment is to “determine whether or not overall goals have been achieved and to provide information on performance for an individual student or statistics about a course or program for internal or external accountability purposes” (MSCHE, 2007, p. 27). Grades are a common form of summative assessment. Both formative and summative assessment are needed to work together to improve learning.

Quantitative evidence consists of data that is represented numerically (MSCHE, 2007). “For instance, performance on a test or responses to a questionnaire may be scored so that a

number represents the degree to which an individual performed or agreed/disagreed with a certain concept” (MSCHE, 2007, p. 33). Quantitative data can be compared directly or subjected to statistical analysis (MSCHE, 2007) and may be generalized to greater populations with larger samples (Campus Labs, 2014). In addition, quantitative methods are often easy to replicate. Qualitative evidence focuses on text or narrative from respondents and seeks to explain and understand (Campus Labs, 2014). Qualitative data can be ‘richer’ than quantitative data because it can provide a larger variety of information (MSCHE, 2007) and can capture “elusive” evidence of student development and learning (Campus Labs, 2014). A misconception is that quantitative assessment is more reliable, valid, and objective than qualitative assessment although this is not necessarily the case. “There are well-designed and statistically reliable means of interpreting and analyzing qualitative data and numerous resources for learning to use qualitative methods (Silverman, 2001; Maxwell, 1996).

An assessment that goes to the whole group is said to be a population assessment, while an assessment that only goes to a subsection of the group is said to be a sample (Campus Labs, 2014). When sending many surveys to the same group, it is beneficial to use population surveys sparingly so the respondents do not suffer from survey fatigue. Sample size calculators are very useful because they will tell you how many members of the population you need to have completed the assessment in order for the data to be statistically valid.

2.12 Student Learning and Accreditation

The Middle States Commission in Higher Education (MSCHE) is one of seven regional accrediting bodies recognized by the Council of Higher Education Accreditation and the U.S. Department of Education. Regional accreditors accredit entire institutions, not individual programs, units, or locations. The University of Maryland, Baltimore is accredited by MSCHE.

The Middle States Commission in Higher Education has two standards organized into two subsections that deal with assessment – institutional context and educational effectiveness (MSCHE, 2007, p. 2). The definitions are below:

Standard 7: The institution has developed and implemented an assessment plan and process that evaluates its overall effectiveness in achieving its mission and goals, its efficiency in the use of its resources, and its effectiveness in assuring that its students and graduates achieve the appropriate learning and other outcomes (MSCHE, 2007).

Standard 14: Assessment of student learning demonstrates that the institution's students have knowledge, skills, and competencies consistent with institutional goals and that students at graduation have achieved appropriate higher education goals. (MSCHE, 2007).

The exact verbiage is different depending on the accrediting body, but assessing student learning is an element in every regional accreditor's standards. Defining and assessing student learning assists faculty in their teaching, students as they select their institutions and in managing their own learning, and administrators as they plan and support students (MSCHE, 2007). Accreditation helps assure the public, legislature, and stake holders that the goals of higher education have been met by "evaluating each institution within the context of its mission" (MSCHE, 2007, p. 1).

2.13 Research & Evaluation

Assessment is different than research. Assessment is conducted by practitioners in the field and results in improving and changing practice. Assessment is involved in day-to-day, here and now, and grounded in sense-making. It can help shape formal research, but is context driven and not generalizable. In addition, an in-depth knowledge of methodology and experimental

design not needed. (Campus Labs, 2014). Formal research is conducted by researchers and practitioners and results in adding to a body of knowledge. Research is involved in long-range and is less action oriented, but instead grounded in exploring new research or expanding or confirming past research. It is generalizable and an in-depth knowledge of methodology and experimental design is needed. Also research is conducted in formal settings or controlled environments and is narrowly focused, driven by past research (Campus Labs, 2014).

Evaluation and assessment are easily confused because instead of being distinct categories they lie along a continuum. Evaluation is the systematic investigation of the merit, worth, or significance of an object, a program, or a process (Shadish, Cook, & Leviton, 1991). Rather than focus on a narrow program or service, evaluation is a broad concept that addresses all aspects of a program. This includes resources, staffing, organization, operations and efficiency (Scriven, 1998). Types of evaluation include, but are not limited to; program evaluation, needs assessment, process evaluation, and cost benefit analysis (Spurlin, 2006).

It is important to distinguish the differences between assessment and evaluation when discussing technology issues (Spurlin, 2006). Questions about technology often revolve around cost-benefit analyses, staffing, support and infrastructure, what students want, what faculty feel they need, and satisfaction with technology support (Spurlin, 2006). These questions are concerned with evaluation. “Assessment focuses on the effect of technology on student learning” (Spurlin, 2006, p. 4). Assessment deals with environment, technology, curriculum, co-curricular activities, instruction, and student variables.

2.14 Variety of Skill Levels among College Students

When researchers have assessed the digital literacy of college students they did not find a homogenous group of digital natives, but instead a group that exhibits a variety of skill levels.

Kennedy, Judd, Dalgarno, & Waycott (2010) conducted a study of 2,096 undergraduate students between ages 17 and 26 from three Australian universities and identified four differentiated groups of technology users: Power users (14 percent), ordinary users (27 percent), irregular users (14 percent), and basic users (45 percent).

Table 2.14.1 Breakdown of Skills Levels (Kennedy et al., 2010)

Skill Level	Description
Power Users (14%)	Power Users use a wide range of technologies and used them significantly more frequently than all other users.
Ordinary Users (27%)	Ordinary Users are regular users of standard web and mobile technologies. While not averse to using emerging technologies and games, they do so no more than monthly and tend not to engage in web publishing and sharing.
Irregular Users (14%)	Irregular Users are similar to ordinary users, but engage in most of the technology-based activities less frequently.
Basic Users (45%)	Basic Users are characterized by extremely infrequent use of new and emerging technologies and less than weekly or monthly use of standard web technologies. They are regular users of standard mobile features.

(p. 337)

The advanced technology power users are in the minority, making up less than 15 percent, while the largest group is basic users, who used only standard web-based applications and mobile phones. It appears that a subset will fit the concept of the tech-savvy digital natives, but these students are in the minority. “In a single class at a university there are major differences in students’ experiences and preferences in relation to technology” (Kennedy et al., 2010).

Jones et al. (2010), in the Net Generation Encountering eLearning at University Project, investigated how much time younger students (25 and below) spent using information communication technology (ICT) for leisure as compared to study in comparison to older students. The study found that older students used ICT more frequently for study, and younger

students used technology more for leisure. In addition, the research showed that even with the spheres of leisure and academic use, students used the technology in a variety of ways (Jones et al., 2010).

Jones and Healing (2010) conducted a series of interviews with student volunteers to learn about how student were engaging with technology and learning. They found that students choose technology based on class format and requirements. A study by Ferri et al., (2008, cited in Jones & Shao, 2011) found that there were at least three different student profiles derived from the intensity of Internet use and the production of content, see Table 2.14.2. Only 30 percent of the students fell into the category closed to the conception of digital natives, a far cry from the blanket statements made about students' web skills.

Table 2.14.2 Student Profiles (Ferri et al., 2008, cited in Jones & Shao, 2011)

Profile	Definition
The digital mass	The digital mass accounts for almost half of the students. The digital mass are heavy Internet users but rarely produce digital content.
The neo-analogical	The neo-analogical account for approximately 20 percent of the students. They produce some content but connect to the Internet less than the average student.
The inter-activated	The inter-activated account for approximately 30 percent of the students. This group is close to the prevalent image of new millennium learners, which is heavy Internet users and quite frequent content producers.

Hargittai (2010) also found that considerable variation exists even among college students with high levels of Internet access. In 2008, she completed her study of 1,060 first-year students, most of them 18 and 19 years old. Hargittai controlled the variables of education and

age, and most of them were highly “wired” with multiple points of Internet access. The students provided self-assessment of their web experience and web use skills. She found that those from families with at least one parent holding a graduate degree exhibit statistically significantly higher levels of know-how about the web than others (2010). In addition, she found that students of lower socioeconomic status, women, students of Hispanic origin, and African Americans exhibit lower levels of Internet literacy than others and engage in fewer information seeking activities (2010).

After reviewing the findings in the literature, it is clear that access and use of computers, the Internet, and technology is present in most of these students’ lives. The mere presence of these tools does not guarantee high competency levels nor explain the vastly different characteristics and skills. Students have a variety of skill levels, but only a small percentage of them operate at the highest level of technology use and digital literacy. College students do not have a universal experience with technology, and many factors affect digital literacy and web use skills.

2.15 Factors that Affect Digital Literacy

After reviewing the literature, it was discovered that generational labels and arguments fail to provide a clear picture of the range of digital literacies of college students. It is trendy to talk about millennials and digital natives and it is easy to assign them characteristics and skills because that helps faculty and staff understand and comprehend them. Generational arguments feel tidy and packaged, but they neglect many other complex factors that play into a student’s digital literacy. Factors such as type of use, parental educational background, availability of the Internet and personal computers (PCs) at home, gender, and race all weave into a complex relationship that can better predict a student’s digital literacy than their age.

In our discussion about socioeconomics of students in higher education, it is important to note that the population of college students is different from that of the general population. Bradley et al. found that college are not representative of the broader population and are skewed toward higher socioeconomic status (2008). Brown & Czerniewicz (2010) suggest that digital natives' attributes are not about a generation but instead characteristics of a "digital elite." Investigating digital literacy uncovers who in the population may be positioned best to benefit from the medium. As more and more information and services become accessible only on the web, then those with lower digital literacy skills will become increasingly disadvantaged (Hargittai, 2005).

In 1995, the 'digital divide' was studied almost exclusively in terms of Internet access. Digital divide refers to "the gap between those who can benefit from digital technology and those who cannot" (Smith, 2013). According to Pew Internet and the American Life Project, in 1995, only 10 percent of Americans were online. In January of 2014, this number has risen to 87 percent of U.S. adults and 97 percent of those between the ages 18 and 29 (Mobile Technology Fact Sheet, 2014).

As that gap between those with Internet access and those without began to close, an assumption remained that when someone was online, inequality was no longer a concern (Hargittai, 2010). Now that more are online, there are still many differences when it comes to how people incorporate the Internet into their lives (Barzilai-Nahon, 2006; DiMaggio, Hargittai, Celeste, & Shafer, 2004). Smith (2013) claims that access is not the real issue anymore but instead it is about the benefits derived from access. Jackson (2007) found that even when more people are online, differences in use "may have the unintended consequence of deepening other divides" (p. 154). DiMaggio and Hargittai (2001) found that secondary digital divides could exist

due to an individuals' differing technical means, autonomy of use, use patterns, social support networks, and skill.

2.16 Recreational Browsing vs. Capital Enhancing

A person's use of the Internet, particularly the differences between recreation-oriented and education-oriented activities, strongly depends on a number of variables such as their parents' educational level, experience with the Internet, and frequency of Internet use, all of which are strongly connected to their socioeconomic status (Mominó, Sigalés, & Meneses, 2008).

Hargittai and Hinnant classify two types of Internet browsing, 1) capital enhancing and 2) recreational browsing (2008). Those that use the Internet for capital enhancing activities are typically more educated, (Howard, Rainie, & Jones, 2001) have privileged backgrounds, (Harigiatti & Hinnant, 2008) and have higher socioeconomic status and Internet usage (Livingstone & Helsper, 2007). Those with a college degree or more are more likely to seek health information, engage in financial transactions, find job information and get news, than those with lower levels of education (Howard et al., 2001). Also, those with lower levels of education are more likely to use the Internet for browsing for fun, online games, and online gambling (Hargittai, 2010).

As discussed above, a second digital divide occurs when you factor in the differences of digital use. An accumulated advantage can increase existing socioeconomic divides and have the potential to contribute to social inequality (Hargittai & Hinnant, 2008; DiMaggio et al., 2004).

2.17 Gender, Web-Use, and Self-efficacy

Gender has been found by some to be a significant predictor of types of Internet use for college students. Jackson et al. (2001) found that male and female students used the Internet equally, but differently. This finding was validated by other researchers (Fortson et al., 2007; Odell et al., 2000), but differs from research by Bressers & Bergen (2002) who found that male college students spend significantly more time on the Internet than female college students.

A trend identified by Fortson et al. (2007) finds male college students are more likely to use the Internet as a source of entertainment and leisure, while female students are more likely to use the Internet for communication and educational experiences. Based on a sample of 843 students from eight American universities, Odell et al. (2000) found male students are more likely to use the Internet to research purchases, look for news, play games, listen/copy music, and look at sex websites. Female college students are less likely to play games online and spend more time using email, bulletin boards and to conduct research for school, but other variables such as school, major, and study habits had a significant effect on those results (Odell et al. 2000). This is in contrast with other research that reported that females spend significantly more time using email than male students (Sherman, 2000). Also it was found that male and female students spend around the same amounts of time using email and there is no statistically significant difference related to academic research, general information searching, job searching, or shopping (Fortson et al., 2007; Bressers & Bergen, 2002).

After reviewing the literature it appears that there is no conclusive difference between male and female students and their web use habits. Trends emerge when you start to consider how gender affects attitudes towards technology and self-efficacy.

Sherman et al. found (2000) that men had more positive attitudes towards Internet use than women. Slate, Manuel, and Brinson Jr., (2002) surveyed Hispanic freshmen at a Southwestern U.S. university and also found that men had more positive attitudes about the Internet than women and felt “more comfort and less confusion” when using the medium. Zhang found that males have less “Internet anxiety” than females (2002, p. 147).

He and Freeman (2010) completed a study on web use and gender and their results suggest female students were found to have less computer knowledge and fewer computing experiences than their male counterparts. In addition, they were more likely to be anxious and have lower levels of computer self-efficacy. Several other studies report findings that males felt more comfortable with the Internet and had more positive attitudes than females (Sherman et al., 2000; Zhang, 2002; Slate et al., 2002). Hargittai & Shafer (2006) found that men have higher levels of self-perceived web-use skills despite similarities in actual skill. In another study, Hargittai (2010) found that women claim lower levels of know-how regarding Internet-related terms and report visiting fewer types of sites than men.

Research by McMillan & Morrison (2006) suggests that the family environment can reinforce gender stereotypes related to Internet use and perception. McMillan & Morrison (2006) conducted a qualitative analysis of 72 autobiographical essays from young adult college students and found that generally, mothers were “reticent in their use of communication technology” (p. 80) while fathers displayed more Internet use and savvy. Another explanation for higher self-efficacy or higher skills are that men have been found to be more likely than women to have had more technology classes in school, more computers in the home in which they grew up, and a personal computer in their own room (Correa, 2010). Others have suggested that

gender is a factor in Internet use because the content on the Internet is biased toward men (Bimber, 2000).

After reviewing this literature, it appears that across the board female students consistently have lower self-efficacy regarding their Internet and web-use skills, and higher Internet anxiety. Some studies show male students having higher scores (Hargittai, 2010), while other studies found that men have higher levels of self-perceived web-use skills despite similarities in actual skill (Hargittai & Shafer, 2006; Madigan, Goodfellow, & Stone, 2007). Livingstone and Helsper (2007) found that a person's Internet skill level has a great impact on the number of activities they complete and perform online. In addition, self-efficacy with technology has been shown to be a significant predictor of a student's future academic and career path (Vekiri & Chronaki, 2008). When students feel more competent they become more motivated to create content (Correa, 2010). Cooper (2006) suggests that if negative stereotypes of female's use of technology continue to be socially reinforced, they may continue to contribute to secondary digital divides between male and female students.

2.18 Race, Web-Use, and Self-efficacy

Generally, studies about race and Internet use find continued evidence of different use and attitudes towards the Internet and technology. Some studies suggest that digital divides based on race are becoming less persistent (Cotton & Jelenewicz, 2006; Jackson et al., 2001b), while others suggest digital divides persist (Cooper, 2006; Slate et al., 2002).

Hargittai and Hinnant found that Asian American students used the web more than other groups regardless of resources or experience (2008). Asian Americans visit more types of websites while students of Hispanic origin visit fewer types of sites than white students (Hargittai, 2010). In the literature, African Americans and Hispanic students report knowing less

about the Internet (Hargittai, 2010), and African Americans score lower on tests measuring information and digital literacy (Sexton, Hignite, Margavio, & Margavio, 2009; Jackson et al., 2008; Ritzhaupt, Feng, Dawson, & Barron, 2013). Regarding diverse types of Internet uses, Hargittai's study suggests "those from a lower socioeconomic background, women, and students of Hispanic origin tend to engage in fewer information-seeking activities online on a regular basis than others" (2010).

Jackson et al. (2008) reported that although more African Americans are online, the intensity and nature of use differs from other racial groups even when controlling for education and income. Black adults are more likely to use the Internet to access religious and spiritual information and less likely to use the Internet for communication (Jackson et al., 2008).

2.19 Education, Income & Disability

Those with lower levels of education are less likely to use the Internet – only 43 percent of adults who did not complete high school use the Internet, as opposed to 71 percent of high school graduates and 94 percent of college graduates (Zickuhr & Smith, 2012). Education is also found to be a strong predictor of what types of online activities a person will pursue (Hargittai, 2010). Respondents with high school education or less are significantly less knowledgeable about the Internet than those with a college degree or higher (Hargittai & Hinnant, 2008).

Education is a strong predictor of the type of activities an individual will participate online. Howard et al. (2001) found that individuals with higher levels of education are more likely to send emails, search for financial, political, or government information, and bank online. In addition, Madden (2003) found that those with higher education and household income are more likely to find news and product information and use the Internet for work. Also, Spooner and Rainie (2000) found that those who have a lower income level are much more likely to use

the Internet to gamble. Hargittai found that undergraduate students with at least one parent with a graduate degree exhibit a much higher knowledge about the Internet even when controlling for other demographics (Hargittai, 2010).

A demographic not often studied are those living with disabilities and their digital literacy or Internet connectivity. The Pew Research Center's Internet and American Life Project found that only 54 percent of adults living with a disability use the Internet, which is much lower than the general population (Zickuhr & Smith, 2012). There is currently a call for more research on how disabilities affect Internet usage and access.

2.20 Access

Access has been an enduring focus of research on digital literacy because it is an obvious precursor of students' use of technology. Access deals with how long students have had access, how many places students have had access, and where they have access. Access has also been studied in terms of access to technology, or to the Internet, sometimes those terms have been used synonymously. Facer and Furlong (2001) observed that access is a much more complex issue than "the mere provision of facilities" because access to a computer does not automatically mean genuine access.

Peter & Valkenburg (2006) found that the longer someone has been using the Internet in years is a predictor of greater and more complex usage in the future. Echoing this, in 2010, Eshet-Alkalai and Chajut (2010) discovered that "experience with technology, and not age-dependent cognitive developments, accounts for the observed life-long changes in digital literacy skills" (p. 173). It appears that rather than age, Internet use in years affects digital literacy skills.

In addition to experience, the number of places that people have access has been shown to affect digital literacy and web-use skills. Hassani (2006) found that people who have more

locations in which they have access tend to benefit more than those with fewer points of access. Hargiatti and Hinnant (2008) found that the more places that people have access to the Internet the greater their Internet mastery and usage. Livingstone and Helsper (2007) found that children who have access to the Internet at home have been users for more years and spend more time online than those who do not have home access. In addition, access on a home computer has been found to have a large impact on digital literacy because it offers autonomy and experiential learning opportunities (Hargiatti & Hinnant, 2008). Users who have more ways to access the Internet are also more likely to use the Internet for beneficial purposes including seeking health information, researching products, purchasing products, and banking online (Hassani, 2006). Trends in socioeconomic factors have begun to emerge to showcase a growing body of literature that reveals the way the Internet is used is a strong indicator of past and future socioeconomic status.

2.21 Conclusion

In conclusion, there are many different definitions and derivatives of digital literacy, and several conceptual frameworks. Some definitions are operational, concerned with technical skills, and others are conceptual, or focused on cognitive and socio-emotional aspects of working in a digital environment (Eshet-Alkalai, 2004). When assessing digital literacy, most of the existing research is found by participants self-reporting their skill levels (van Dijk, 2006), often referred to as self-efficacy (Bandura, 1977). This is an indirect measure as opposed to a direct measure that assesses users' actual knowledge of digital literacy. There are a few existing instruments that measure digital literacy including Educational Testing Service's (ETS) iSkills, Hargittai's web-use skills index (2005), and the Digital Competency Assessment (DCA). Assessment of digital literacy skills can be difficult and expensive on a large scale.

The technological skills and habits of digital natives have been studied, and the concept of a homogenous group of tech savvy digital natives has recently been refuted empirically and theoretically through comprehensive literature reviews (Jones & Shao, 2011; Bennett, Maton, & Kervin, 2008). Instead, digital natives have been found to possess a large variation of technology use and skills (Kennedy et al., 2007). Although there is a growing body of literature about the digital literacy of undergraduate students, there has been little, if any, research completed on the population of graduate and professional students. There are educational differences between graduate and undergraduate students (Hussey & Smith, 2010; Artino & Stephens, 2009; Seligman, 2012), and even among academic disciplines there are varying degrees of technology use (Weng & Ling, 2007; Fry, 2004; Fry, 2006; Guidry & BrckaLorenz, 2010). It is plausible that graduate students differ from undergraduate students and that there are differences in the digital literacy skills of students enrolled in different academic disciplines.

The argument for supporting the idea of digital natives is often criticized for neglecting to study race, socioeconomic factors, and previous experience with technology (Vaidhyathan, 2008). Factors such as type of use, parent's educational background, availability of the Internet and PCs at home, gender, and race all weave into a complex relationship that can better predict a student's digital literacy than age.

CHAPTER III

METHODOLOGY

3.1 Participants

The study population consisted of 4,996 graduate and professional students at the University of Maryland, Baltimore (UMB). Data were collected during the 2014-2015 academic year. This population included students in the Schools of Nursing (n=1,119), Social Work (n=957), Law (n=914), Medicine (n=843), Pharmacy (n=646), and Dentistry (n=517). Students from the Graduate School were excluded.

The Web-use Index was distributed to the entire population of 4,996 potential participants. Six hundred and ninety-nine participants completed and returned the survey for a total response rate of 14 percent. Responses from undergraduate participants were excluded from the results (n=99) as the study was designed to investigate web-use skills of graduate and professional students. In addition, participants from the Graduate School were removed (n=50), as the variety of degree programs offered by this school prevents specific determination of whether the academic discipline had an effect on participants' web-use skills.

Six participants indicated on the survey that they were Physical Therapy students. Their classification was changed to School of Medicine, as that program is a part of the School of Medicine. Eleven participants marked Question #11 incorrectly and they were removed from the sample, due to lack of attentiveness. Question #11 asked "The purpose of this question is to assess your attentiveness to question wording. For this question please mark the Very Often response," and presented answer choices of "Never, Rarely, Sometimes, Often, and Very Often."

The seven participants who did not answer all of the self-reported rated terms were removed from the study sample, as this survey was modeled after Hargittai and Hsieh's (2012) Web-use Index, and their methodology specified that missing values be excluded. The participant who identified as transgender was excluded due to the small sample size (n=1).

Five hundred and fifteen eligible participants remained in the sample, which now included students from the School of Dentistry (n=50), School of Law (n=78), School of Medicine (n=117), School of Nursing (n=72), School of Pharmacy (n=67), and School of Social Work (n=131) (See Table 3.1.1).

Table 3.1.1 Percentage of Participation from Each Academic Discipline

Academic Discipline	Total Students	Participants	% Participants for Each Academic Discipline
Dental	517	50	9.6%
Law	914	78	8.5%
Medicine	843	117	13.9%
Nursing	1,119	72	6.4%
Pharmacy	646	67	10.4%
Social Work	957	131	13.7%

3.2 Instrument and Variables

Hargittai & Hsieh's Web-use Index was modeled as the instrument for this study (2012). The survey was adapted slightly to study the effects of academic discipline, gender, age, race/ethnicity, parental education, international status, self-perceived Internet skills, and GPA. The web-use skills index is a survey originally developed by Ezter Hargittai in 2005 as a proxy for observed skill measures, which are often expensive and difficult to collect for large samples of people. The survey was based on a study that examined users' digital literacy through both observations and survey. The survey has changed over the year to ensure the variables reflect

current web terminology and trends. The analysis of the study yielded recommendations for what measures work well as survey proxies of people's observed web-use skills (Hargittai, 2005; Hargittai, 2009; Hargittai & Hsieh, 2012). I corresponded with Dr. Hargittai via email (April 7, 2014) and to best of Hargittai's knowledge this will be the first time the survey has been used to assess the web-use skills of graduate and professional students. She has used it with both undergraduate students (2009), and the general population (2005).

The adapted Web-use Index included eight independent variables, and 30 dependent variables. The independent variables included academic discipline, race/ethnicity, gender, parental education, age, international status, GPA, and self-perceived Internet skills. Academic discipline indicated which school at UMB the participant was enrolled in. Options for academic discipline were Dental, Law, Medicine, Nursing, Pharmacy, and Social Work. In the case of this study, race refers to physical characteristics such as skin pigment, while ethnicity refers to cultural factors such as nationality and ancestry. The two definitions were combined to create the variable Race/Ethnicity. Options for Race/Ethnicity included Asian/Pacific Islander, Black/African American, Hispanic, White/Caucasian, and Other. Gender is the state of being male, female, transgender or other, and participants identified which category they associated with. Parental Education is defined as the highest level of education attained by either parent. If the parent is currently enrolled, then the highest degree received was the one to be recorded. Options for Parental Education were Some high school, no diploma; High school graduate, diploma or the equivalent; Some college credit, no degree; College degree; and Graduate or professional degree.

Age was captured as age in years, and was a write in variable. The average age of participants taking the survey was 27.6 years old. GPA was grade point average and was a write-

in variable. The average GPA of participants was 3.48. Each school's catalog was reviewed and it was confirmed that all graduate and professional schools at UMB measure grades through GPAs, although there are differences in the ranges collected. The schools of Medicine, Law, and Social Work have GPAs that range from 0.00 – 4.30, while the schools Nursing, Dental and Pharmacy have GPAs that range from 0.00 – 4.00. In addition, this was verified with the registrar at UMB. Also, it was confirmed that pass/fail courses do not factor into a participant's GPA. First semester students do not yet have GPAs, so that was addressed by inquiring if participants were first semester students. If they selected yes, skip logic was used to have participants skip the question asking about GPA.

International status indicates whether the participant was an international student or not. Self-perceived Internet skills asked participants to rate their own Internet skills. Options for self-perceived Internet skills included Not at All Skilled, Not Very Skilled, Fairly Skilled, Very Skilled, and Expert.

Table 3.2.1 Independent Variables

Independent Variable	Coding	Unit of Measure
Academic discipline	1 = Dental 2 = Law 3 = Medicine 4 = Nursing 5 = Pharmacy 6 = Social Work 7 = Other	Categorical
Race/Ethnicity	1 = Asian/Pacific Islander 2 = Black/African American 3 = Hispanic 4 = White/Caucasian 5 = Other, please explain	Categorical
Gender	1 = Male 2 = Female 3 = Transgender 4 = Other	Categorical

Parental Education	1 = Some high school, no diploma 2 = High school graduate, diploma or the equivalent 3 = Some college credit, no degree 4 = College degree 5 = Graduate or professional degree	Categorical
Age	Open ended, write-in	Years
International Status	1 = Yes 2 = No	Categorical
GPA	Open ended, write-in	Grade-point average
Self-perceived Internet Skills	1 = Not at all skilled 2 = Not very skilled 3 = Fairly skilled 4 = Very Skilled 5 = Expert	Categorical

The dependent variables evaluated were bcc (on email), blog, bookmark, bookmarklet, cache, favorites, fitibly, firewall, frames, JFW, JPG, malware, newsgroup, PDF, phishing, podcasting, preference setting, proxypod, reload, RSS, social bookmarking, spyware, tabbed browsing, tagging, torrent, web feeds, weblog, widget, and wiki. Each participant was asked to evaluate their familiarity with Internet-related terms on a scale between 1 and 5 where 1 represents having “no understanding” and 5 represents having “a full understanding” of the variable. Participants were instructed not to Google the variable to discover meaning.

Three of the variables were not real terms to test if individuals were randomly selecting terms. These three terms include Fitibly, JFW, and Proxypod. While there are no corresponding measures of actual skill except that which is self-reported, non-existing terms yielded the lowest means (See Table 3.2.2). The full instrument can be seen in Appendix A.

Table 3.2.2 Dependent Variables

Dependent Variable	Definition	Mean Score (1 = lowest, 5 = highest)
Advanced search	A feature offered by most search engines and search tools on the Web. Advanced search gives the Web searcher the ability to narrow their searches by a series of different filters; i.e., language, proximity, domain, etc.	4.10
Bcc (on email)	Short for blind carbon copy, a copy of an e-mail message sent to a recipient without the recipient's address appearing in the message. This is useful if you want to copy a message to many people without each of them seeing who the other recipients are.	4.36
Blog	A website containing a writer's or group of writers' own experiences, observations, opinions, etc., and often having images and links to other websites.	4.23
Bookmark	To mark a document or a specific place in a document for later retrieval. Nearly all Web browsers support a bookmarking feature that lets you save the URL of a Web page so that you can easily re-visit the page at a later time.	4.61
Bookmarklet	A direct link to a specific function or feature within a Web page. While a browser bookmark takes you to a specific page, the bookmarklet will take you to a function, such as a specific search (including the search phrase) on a Web page, a tagged location on Google maps and others.	1.64
Cache	Pronounced cash, a special high-speed storage mechanism. It can be either a reserved section of main memory or an independent high-speed storage device. Two types of caching are commonly used in personal computers: memory caching and disk caching.	2.85
Favorites	Nearly all Web browsers support this feature that lets you save the address (URL) of a Web page so that you can easily re-visit the page at a later time. Synonymous with bookmark.	2.56
Fitibly	A fake variable, this term is not real.	1.26
Firewall	Firewall systems prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software, or both.	3.42

Frames	A feature supported by most modern Web browsers than enables the Web author to divide the browser display area into two or more sections (frames).	2.07
JFW	A fake variable, this term is not real.	1.30
JPG	Pronounced jay-peg, JPEG is a lossy compression technique for color images. Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression.	3.97
Malware	Short for malicious software, malware is software designed specifically to damage or disrupt a system, such as a virus or a Trojan horse.	3.57
Newsgroup	Same as forum, an online discussion group. On the Internet, there are thousands of newsgroups covering every conceivable interest.	2.44
PDF	Short for Portable Document Format, a PDF is a file format developed by Adobe Systems. PDF captures formatting information from a variety of desktop publishing applications, making it possible to send formatted documents and have them appear on the recipient's monitor or printer as they were intended.	4.53
Phishing	An email that falsely claims to be a legitimate enterprise in an attempt to scam the user into surrendering private information to be used for identity theft.	3.40
Podcasting	Podcasting is similar in nature to RSS, which allows subscribers to subscribe to a set of feeds to view syndicated website content. With podcasting however, you have a set of subscriptions that are checked regularly for updates and instead of reading the feeds on your computer screen, you listen to the new content on your iPod (or like device).	3.85
Preference setting	Preference setting is changing your profile preferences to adapt the user options for browsing, editing, searching and notifications to your needs.	3.96
Proxypod	A fake variable, this term is not real.	1.46
Reload	Generally, to update something with new data. For example, some Web browsers include a reload button that updates the currently displayed Web pages. This feature is also called refresh.	

RSS	RSS is the acronym used to describe the de facto standard for the syndication of Web content. RSS is an XML-based format and while it can be used in different ways for content distribution, its most widespread usage is in distributing news headlines on the Web. A Website that wants to allow other sites to publish some of its content creates an RSS document and registers the document with an RSS publisher. A user that can read RSS-distributed content can use the content on a different site.	4.22
Social Bookmarking	Commonly used in blogs, site authors attach keyword descriptions (called tags) to identify images or text within their site as a categories or topic. Web pages and blogs with identical tags can then be linked together allowing users to search for similar or related content. If the tags are made public, online pages that act as a Web-based bookmark service are able to index them. tags can be created using words, acronyms or numbers. Tags are also called tagging, blog tagging, or folksonomies (short for folks and taxonomy).	2.06
Spyware	Software that covertly gathers user information through the user's Internet connection without his or her knowledge, usually for advertising purposes.	3.51
Tabbed Browsing	Tabbed browsing is a function of some Web browsers that allow uses to surf and view multiple pages by loading the Web sites into "tabbed" sections of one page, rather than multiple pages.	4.00
Tagging	Commonly used in blogs, site authors attach keyword descriptions (called tags) to identify images or text within their site as a categories or topic. Web pages and blogs with identical tags can then be linked together allowing users to search for similar or related content. If the tags are made public, online pages that act as a Web-based bookmark service are able to index them.	4.08
Torrent	BitTorrent is a file distribution system used for transferring files across a network of people. As you download a file, BitTorrent places what you download on upload for other users; when multiple people are downloading the same file at the same time they upload pieces of the file to each other. BitTorrent pieces together the file you are downloading, to where the first part of a file you get may be the last part someone else gets. As you continue to retrieve the file, BitTorrent also uploads data to other users. For example, a person with 98 percent of the file done is	2.74

directed to the people with the 2 percent of the file they still need. The files downloaded via BitTorrent are called torrents.

Web feeds	A Web document that is a shortened version of a Web page that has been created for syndication. Feeds usually end in .xml or .rss.	3.03
Weblog	A weblog is a Web page that serves as a publicly accessible personal journal for an individual. Typically updated daily, weblogs often reflect the personality of the author. Weblogs are also called blogs.	2.99
Widget	Widget is a generic term for the part of a user interface that allows the user to interface with the application and operating system. Widgets display information and invite the user to act in a number of ways. Typical widgets include buttons, dialog boxes, pop-up windows, pull-down menus, icons, scroll bars, resizable window edges, progress indicators, selection boxes, windows, tear-off menus, menu bars, toggle switches and forms.	3.08
Wiki	A collaborative Web site comprises the perpetual collective work of many authors. Similar to a blog in structure and logic, a wiki allows anyone to edit, delete or modify content that has been placed on the Web site using a browser interface, including the work of previous authors.	4.00

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3.3 Procedure

IRB approval was sought from both UMB and the University of Baltimore in the summer of 2014. The study was exempt at both institutions. See Appendix B for documentation.

Participant information was de-identified to ensure confidentiality of participants participating in the research study.

Graduate and professional students were identified in the directory at UMB and emailed an electronic survey measuring web-use skills in September of 2014. Students had two weeks to take the assessment, from Wednesday, September 17, 2014 through Wednesday, October 1,

2014. The electronic survey was accessible at all times during the two-week period and could be taken anywhere the participant had Internet access.

The survey was introduced via email with an informed consent (See Appendix C). Two reminders were sent to non-respondents only over the two-week period. After the study was over, one email address was chosen using an online number randomizer and that student was given an iPad mini. Only one student was eligible to win a prize and that was distributed the day after the survey.

3.4 Hypothesis

The primary purpose of this study was to examine whether academic discipline was associated with web-use skills among the graduate and professional students at the University of Maryland, Baltimore. To the best of this author's knowledge, the effect of academic discipline on digital literacy has not yet been investigated in the literature. When applying Biglan's (1973) paradigm of academic disciplines matrix to UMB's graduate and professional schools, it is apparent that the schools fall in different dimensions. Medicine, Pharmacy, Dentistry, and Nursing are applied, hard, and life disciplines. Social Work is a pure, soft, life discipline, and Law is an applied, soft, and non-life discipline. Research has shown that differing academic disciplines have varying levels of ICT use (Weng & Ling, 2007; Fry, 2004; Fry, 2006). Based off of Biglan's framework and consequent research, the different disciplines at UMB may be associated with different uses of ICT and varying levels of digital literacy skills.

The secondary purpose of the study was to investigate how age, gender, race, parental education, international status, GPA, and self-perceived skills affect web-use skills. In current

literature, these variables have been shown to be associated with digital literacy. These factors are addressed in depth in Sections 2.15 through 2.20.

Primary hypothesis

H₁: Academic discipline is not associated with web-use skills among graduate and professional students.

H_A: Academic discipline is associated with web-use skills among graduate and professional students.

Secondary hypotheses

H₂: Asian/Pacific Islander and White/Caucasian participants will score higher than Black/African American, Hispanic, and Other participants.

H₃: Male participants will perceive themselves to be more competent users of technology and have higher web-use skills than female participants.

H₄: Higher Parental education will be positively related to web-use skills.

H₅: Students with higher web-use skills will also have higher GPAs.

H₆: Age is not associated with web-use skills among graduate and professional students.

H₇: International status is not associated with web-use skills among graduate and professional students.

3.5 Power Analysis and Sample Size

A power analysis was completed in the statistical software SAS version 9.1.3 “proc power” to determine an adequate sample size for the survey. An R^2 value of 0.21 was used from previous research completed by Hargittai measuring variation in web use skills among undergraduate college students (2010). Hargittai determined the R^2 when she was exploring the effect that age, gender, parental education, and race/ethnicity have on individuals’ Internet skills.

A sample size between 445 and 719 participants was needed to achieve a power range between 0.90 and 0.99 (See Table 3.5.1). If by the end of the two-week period less than 445 students had taken the survey, a third and fourth reminder would have been send out to non-respondents timed one week apart. If the desired number of participants had still not been reached, another survey or assessment method would have been considered. Fortunately, a third and fourth reminder was unnecessary, as the number of desired participants was reached before the two week period was over.

Table 3.5.1 Power Analysis for Sample Size

Power	Sample Size Needed at Levels of R^2 for the Full Model								
	$R^2=0.1$	$R^2=0.2$	$R^2=0.3$	$R^2=0.4$	$R^2=0.5$	$R^2=0.6$	$R^2=0.7$	$R^2=0.8$	$R^2=0.9$
0.70	320	285	250	216	181	146	112	77	44
0.75	353	314	276	237	199	161	122	84	48
0.80	391	348	306	263	220	178	135	93	52
0.85	438	390	342	294	246	198	151	103	57
0.90	500	445	391	336	281	226	171	117	63
0.95	600	534	468	402	336	270	204	139	74
0.99	808	719	630	541	452	363	274	185	96

Assumptions: Alpha set at 0.05; Number of predictors in full model = 20; Number of test predictors = 5
Difference in R-squared set at 0.02

3.6 Statistical Methods

Nonparametric procedures do not require assumptions about the parameters of the populations represented by the samples. In particular, nonparametric data does not assume that the populations form a normal distribution or any particularly shaped distribution. Nonparametric statistics are used when the scores are from very skewed or otherwise non-normal distributions, when the samples have significantly heterogeneous variances, or when the scores are from an ordinal (ranked) or nominal data (categorical) (Heinman, 1992).

The Kruskal-Wallis H test was chosen because of its use for independent samples and is the nonparametric equivalent to the one-way analysis of variance (ANOVA). The Kruskal-Wallis H test differs from the ANOVA because it does not depend on the assumption that the sample is normally distributed. It can be performed on ranked data, which means you convert the smallest measurement to a rank of 1, the next smallest to a rank of 2, and so on. It assumes that the study involves one independent variable and that there are three or more independent variables.

To use the Kruskal-Wallis H Test, four assumptions must be met. Assumption 1 states that the dependent variable should be measured at the ordinal or continuous level (i.e., interval or ratio). The dependent variables in the study are ranked on a scale of 1 to 5, so the ordinal ranked data so assumption 1 is met. Assumption 2 states that independent variables should consist of two or more categorical, independent groups. Two examples of independent variables that meet this criterion include race/ethnicity (e.g., five groups: Asian/Pacific Islander, Black/African American, Hispanic, White/Caucasian, and Other), and academic discipline (e.g. seven groups: Dental, Law, Medicine, Nursing, Pharmacy, Social Work, and Other). Assumption 3 states that there should be independence of observations, which means that there is no relationship between the observations in each group or between the groups themselves. This assumption is met

because each independent variable has different participants and no participant is in more than one group. Last, Assumption 4 states that in order to know how to interpret the results from a Kruskal-Wallis H test, you have to determine whether the distributions in each independent variable have the same shape. For this study, that assumption was not met as independent variables had different distribution shapes. Since the fourth assumption was not met, instead of being able to compare the medians of the dependent variables we will need to compare mean ranks. Although the last assumption was not met, with this modification a Kruskal-Wallis H test can still be used with the data (Laerd Statistics, 2015).

The Kruskal-Wallis H test is an omnibus statistic and cannot tell you which specific groups of independent variables are statistically significantly different from each other. Instead, the Kruskal-Wallis H test tells you that at least two groups are different. Since this study is examining students from six academic disciplines, there are more than two groups in the study design. To determine which variables differed from each other, a Fishers Least Significant Difference (LSD) test was used as a post hoc test to determine differences. If one of the expected values for a group is less than five, which is true for some instances of this study, Fisher's LSD can be applied. Fisher's LSD has one assumption, which is that there should be independence of observations, or no relationship between the observations in each group or between the groups themselves. Like with the Kruskal-Wallis H, this assumption is met because each independent variable has different participants and no participant is in more than one group.

The Kruskal-Wallis H Test has been used in other similar studies with ordinal ranked data. The Kruskal-Wallis H has been used to analyze adult learners access and attitudes towards digital technology (Jeffs & Richardson, 2013), self-perceived information literacy (Bronstein &

Tzivian, 2013), and information problem solving while using the Internet (Brand-Gruwel, Wopereis, & Walraven, 2008).

CHAPTER IV

RESULTS

The results of this study examine whether academic discipline was associated with web-use skills among the graduate and professional students at the University of Maryland, Baltimore. The secondary purpose of the study was to investigate how age, gender, race, parental education, international status, GPA, and self-perceived skills are related to web-use skills. The results chapter examines the statistical significance of each variable.

4.1 Study Sample Description and Demographics

A comparison of the demographics of this sample to the population of the University community shows that the sample is representative. Overall, the total graduate and professional population at UMB is 29 percent male and 71 percent female. Twenty three percent of the sample is male, and 77 percent of the sample is female (See Table 4.1.1).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by gender. The schools of Nursing and Social Work are not statistically different from each other, and also the schools of Dental, Law, Medicine, and Pharmacy are not statistically different from each other. However, the schools of Nursing and Social Work are statistically different from the schools of Dental, Law, Medicine, and Pharmacy due to their much higher percentage of female participants.

Table 4.1.1 Gender by Academic Discipline

Gender	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
Male	20 (40.0%)	26 (33.3%)	37 (31.6%)	4 (5.6%)	18 (26.9%)	12 (9.2%)	117 (23%)
Female	30 (60.0%)	52 (67.7%)	80 (68.4%)	68 (94.4%)	49 (73.1%)	119 (90.8%)	398 (77%)

The racial composition of the sample also reflects the composition of the population.

Sixty-one percent of the university population is Caucasian, and 39 percent are minorities. Sixty-three percent of the sample is Caucasian. The academic discipline with the highest non-Caucasian population is the School of Pharmacy (56.7%) followed closely by the School of Dentistry (48.0%). The least racially diverse academic discipline is the School of Social Work with 72.5 percent Caucasian, followed by the School of Medicine with 70.1 percent Caucasian participants (See Table 4.1.2).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by race. The racial composition of the School of Pharmacy is statistically significant different than all schools except for the School of Dentistry. Both Pharmacy and Dental have a similar percentage of Asian/Pacific Islander participants. The schools of Medicine, Nursing, and Social Work are not significantly different from each other and are primarily Caucasian. The schools of Nursing and Social Work are statistically significant different than the Schools of Law, Dentistry, and Pharmacy. The School of Medicine is statistically different than the schools of Dentistry and Pharmacy, and the School of Dentistry is different than the schools of Social Work, Nursing, and Medicine.

Table 4.1.2 Race/Ethnicity by Academic discipline

Race/Ethnicity	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
Asian/Pacific Islander	18 (36.0%)	13 (16.7%)	25 (21.4%)	3 (4.2%)	29 (43.3%)	5 (3.8%)	93 (18.1%)
Black/African American	3 (6.0%)	14 (18.0%)	3 (2.6%)	11 (15.3%)	6 (9.0%)	23 (17.6%)	60 (11.7%)
Hispanic	4 (8.0%)	5 (6.4%)	3 (2.6%)	6 (8.3%)	1 (1.5%)	5 (3.8%)	24 (4.7%)
White/Caucasian	24 (48.0%)	46 (59.0%)	82 (70.1%)	52 (72.2%)	29 (43.3%)	95 (72.5%)	328 (63.7%)
Other	1 (2.0%)	0 (0.0%)	4 (3.4%)	0 (0.0%)	2 (3.0%)	3 (2.3%)	10 (1.9%)

A total of 3 percent of participants are international students, which is comparable to the to 4 percent of international students at UMB. Of all academic disciplines, the School of Pharmacy has the highest percentage of international participant respondents at 11.9 percent, followed by the School of Dentistry, which hosts an international population of 6 percent. The academic discipline with the lowest international participant population is the School of Social Work (0.8 % International students), followed closely by the School of Medicine (0.9% International students) (See Table 4.1.3).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by international population. The Schools of Nursing, Social Work, Law, and Medicine are not statistically different from each other. The Schools of Nursing and Social Work are statistically different from the Schools of Dental and Pharmacy. The School of Pharmacy is statistically different from all other schools.

Table 4.1.3 Percentage of International Participants by Academic discipline

International Status	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
International Student	3 (6.0%)	1 (1.3%)	1 (0.9%)	0 (0.0%)	8 (11.9%)	1 (0.8%)	14 (2.7%)
Not an International Student	47 (94.0%)	77 (98.7%)	116 (99.1%)	72 (100.0%)	59 (88.1%)	130 (99.2%)	501 (97.3%)

The majority of participants (71.5%) were between 22 and 28 years old and only 7.2 percent of participants were older than 40 years of age. The School of Nursing had the highest percentage of older participants with 27.8 percent of its participants older than 40 years of age. The School of Pharmacy had the highest percentage of participants under 22 of age (13.4%) (See Table 4.1.4).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by age. The schools of Dentistry, Law, Medicine, and Pharmacy were not statistically different from each other based on age. The School of Nursing was statistically different than every other school, and the School of Social Work was different than all schools except for the School of Dentistry.

Table 4.1.4 Age by Academic Discipline

Age	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
<22 years	1 (2.0%)	2 (2.6%)	5 (4.3%)	1 (1.4%)	9 (13.4%)	5 (3.8%)	23 (4.5%)
22 – 24 years	20 (40.0%)	37 (47.4%)	47 (40.2%)	7 (9.7%)	25 (37.3%)	41 (31.3%)	117 (34.4%)
25 – 28 years	25 (50.0%)	32 (41.0%)	49 (41.9%)	22 (30.6%)	23 (34.3%)	40 (30.5%)	191 (37.1%)
29 – 40 years	4 (8.0%)	6 (7.7%)	15 (12.8%)	22 (30.6%)	5 (7.5%)	35 (26.7%)	87 (16.9%)
> 40 years	0 (0.0%)	1 (1.3%)	1 (0.09%)	20 (27.8%)	5 (7.5%)	10 (7.6%)	37 (7.2%)

Participants rated themselves on self-perceived Internet skill so that the effect of self-perceived skill on the Web-use Index could be investigated. No participant rated himself or herself as “not at all skilled” and only 2.1 percent of participants rated themselves as not very skilled. Almost forty two percent of participants rated themselves as fairly skilled, 48.9 percent as very skilled, and 6.4 percent as expert. Eleven and a half percent of law participants and 9.0 percent of pharmacy participants rated themselves as experts. Overall, only 2.7 percent of participants rated themselves as not very skilled, or not at all skilled, so most participants rated themselves as fairly skilled or above. Participants from the School of Law rated themselves the highest, with 65.4 percent of participants rating themselves very skilled or expert. Participants from the School of Dentistry rated their skills the lowest, as 56 percent of participants rated themselves as fairly skilled or below (See Table 4.1.5).

Post hoc comparisons using the Fisher LSD test revealed that there was no statistically significant difference between academic disciplines by self-perceived Internet skill.

Table 4.1.5 Self-Perceived Skill by Academic discipline

Self-perceived Internet Skills	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
Not at all skilled	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Not very skilled	3 (6.0%)	1 (1.3%)	3 (2.6%)	1 (1.4%)	2 (3.0%)	4 (3.1%)	14 (2.7%)
Fairly skilled	25 (50.0%)	26 (33.3%)	45 (38.5%)	33 (45.8%)	30 (44.8%)	57 (43.5%)	216 (41.9%)
Very skilled	21 (42.0%)	42 (53.9%)	61 (52.0%)	36 (50.0%)	29 (43.3%)	63 (48.1%)	252 (48.9%)
Expert	1 (2.0%)	9 (11.5%)	8 (6.8%)	2 (2.8%)	6 (9.0%)	7 (5.3%)	33 (6.41%)

Parental education was assessed because it has been found to be related to academic achievement (Klebanov, Brooks-Gunn, & Duncan, 1994) and an indicator of higher digital

literacy skills (Hargittai, 2010). The average amount of parental education varied by the academic discipline of the participant. The academic discipline with the highest number of graduate or professional degrees for parental education was the School of Medicine at 60.7 percent. The lowest was the School of Pharmacy at 32.8 percent. Overall, almost 50 percent of the participants had parents with degrees from graduate and professional schools. Thirty four percent of all participants reported that their parents had college degrees. Only 16.4 percent of participants had parents who did not have college degrees (See Table 4.1.6).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by parental education. The Schools of Law, Nursing, Pharmacy, and Social Work were not statistically different from each other based on parental education. There were also no statistically significant differences between the schools of Dentistry and Medicine. The Schools of Dentistry and Medicine were significantly different than the Schools of Nursing, Pharmacy, and Social Work.

Table 4.1.6 Parental Education by Academic Discipline

Parental Education	Dental (n=50)	Law (n= 78)	Medicine (n=117)	Nursing (n=72)	Pharmacy (n=67)	Social Work (n=131)	Total (n=515)
Some high school, no diploma	0 (0.0%)	1 (1.3%)	0 (0.0%)	3 (4.17%)	3 (4.5%)	3 (2.3%)	10 (1.9%)
High school graduate/diploma or the equivalent	2 (4.0%)	7 (9.0%)	6 (5.1%)	11 (15.3%)	5 (7.5%)	15 (11.5%)	46 (8.9%)
Some college credit, no degree	2 (4.0%)	6 (7.7%)	4 (3.4%)	1 (1.4%)	3 (4.5%)	13 (9.9%)	29 (5.6%)
College degree	14 (28.0%)	25 (32.1%)	36 (30.8%)	23 (31.9%)	34 (50.8%)	43 (32.8%)	175 (34.0%)
Graduate or professional degree	32 (64.0%)	39 (50.0%)	71 (60.7%)	34 (47.2%)	22 (32.8%)	57 (43.5%)	225 (49.5%)

GPA was assessed as a proxy for academic achievement, although it is noted that there is variation in GPA by academic discipline. Participants from the School of Social Work reported having the highest GPAs with 72.9 percent of students reporting GPAs greater than 3.7. The School of Nursing had the second highest percentage of GPAs (39.6%). The School of Law had the lowest GPAs with 43.5 percent of participants less than 3.3, followed closely by the School of Medicine with 43.3 percent under 3.3 (See Table 4.1.7).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between academic disciplines by GPA. The Schools of Dentistry, Medicine, and Pharmacy were not statistically different from each other based on GPA, although the School of Dentistry was significantly different than the School of Law. The schools of Law, Medicine, and Pharmacy were not statistically different from one another. The School of Social Work was statistically different than all other schools by GPA. In addition, the School of Nursing was statistically different than all schools except for the School of Dentistry.

Table 4.1.7 GPA by Academic Discipline

GPA*	Dental (n=40)	Law (n=46)	Medicine (n=76)	Nursing (n=48)	Pharmacy (n=41)	Social Work (n=59)	Total (n=310)
< 3.3	13 (32.5%)	20 (43.5%)	33 (43.4%)	6 (12.5%)	16 (39.1%)	3 (5.1%)	91 (29.6%)
3.3 – 3.7	14 (35.0%)	20 (43.5%)	27 (35.5%)	23 (47.9%)	18 (43.8%)	13 (22.0%)	115 (37.1%)
> 3.7	13 (32.5%)	6 (13.0%)	16 (21.1%)	19 (39.6%)	7 (17.1%)	43 (72.9%)	104 (33.6%)

* First semester students (n = 205) do not have GPAs. GPA sample size was n = 310

Previous research has found that race and gender affect web-use skills (Hargittai, 2010; Hargittai & Hinnant, 2008). Because of this, an analysis of the demographics of race and gender was performed. Black/African American participants have the highest percentage of female

participants (93.3%), followed by Other (90.0%), Hispanic (79.2%), White/Caucasian (75.0%), and Asian/Pacific Islander (73.1%) (See Table 4.1.8).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between race/ethnicities by gender. There were no statistically significant differences between the gender make-up between Asian/Pacific Islanders, Hispanics, White/Caucasians, or participants that identified as Other race/ethnicities. There was a statistically higher percentage of females when comparing Black/African Americans with White/Caucasian and Asian/Pacific Islander participants.

Table 4.1.8 Gender and Race

Gender	Asian/Pacific Islander	Black/African American	Hispanic	White/Caucasian	Other	Total
	68	56	19	246	9	398
Female	(73.1%)	(93.3%)	(79.2%)	(75.0%)	(90.0%)	(77.3%)
	25	4	5	82	1	117
Male	(26.9%)	(6.7%)	(20.8%)	(25.0%)	(10.0%)	(22.7%)

In addition, it is also important to consider gender and academic discipline when controlling for race. For Asian/Pacific Islander, Hispanic, and White/Caucasian participants the percentage of female participants make up about three fourths of the population. This contrasts from the population of Black/African American and Other participants, where females make up 93.3% and 90.0% of the population respectively (See Table 4.1.9).

Table 4.1.9 Gender and School Controlling for Race

Controlling for Asian Pacific Islander Participants							
Gender	Dental	Law	Medicine	Nursing	Pharmacy	Social Work	Total
	12	6	20	3	23	4	68
Female	(66.7%)	(46.2%)	(80.0%)	(100.0%)	(79.3%)	(80.0%)	(73.1%)
	6	7	0	6	1	25	
Male	(33.3%)	(53.9%)	5 (20.0%)	(0.0%)	(20.7%)	(20.0%)	(26.9%)
Controlling for Black/African American Participants							
Gender	Dental	Law	Medicine	Nursing	Pharmacy	Social Work	Total
	3	13	3	10	4	23	56
Female	(100.0%)	(92.9%)	(100.0%)	(90.9%)	(66.7%)	(100.0%)	(93.3%)
	0	1	0	1	2	0	4
Male	(00.0%)	(7.1%)	(0.0%)	(9.1%)	(33.3%)	(00.0%)	(6.7%)
Controlling for Hispanic Participants							
Gender	Dental	Law	Medicine	Nursing	Pharmacy	Social Work	Total
	2	4	2	6	0	5	19
Female	(50.0%)	(80.0%)	(66.7%)	(100.0%)	(0.0%)	(100.0%)	(79.2%)
	2	1	1	0	1	0	5
Male	(50.0%)	(20.0%)	(33.3%)	(0.0%)	(100.0%)	(0.0%)	(20.8%)
Controlling for Caucasian/White Participants							
Gender	Dental	Law	Medicine	Nursing	Pharmacy	Social Work	Total
	12	29	52	49	20	84	246
Female	(50.0%)	(63.0%)	(63.4%)	(94.2%)	(69.0%)	(88.4%)	(75.0%)
	12	17	30	3	9	11	82
Male	(50.0%)	(37.0%)	(36.6%)	(5.8%)	(31.0%)	(11.6%)	(25.0%)
Controlling for Other Participants							
Gender	Dental	Law	Medicine	Nursing	Pharmacy	Social Work	Total
	1	0	3	0	2	3	9
Female	(100.0%)	(0.0%)	(75.0%)	(0.0%)	(100.0%)	(100.0%)	(90.0%)
	0	0	1	0	0	0	1
Male	(0.0%)	(0.0%)	(25.0%)	(0.0%)	(0.0%)	(0.0%)	(10.0%)

Hargittai and her colleagues (2008; 2010) found that race interacts with self-efficacy regarding web-use skills. Because of this, an analysis the demographics of race and self-perceived Internet skills was performed. Hispanic participants ranked themselves as having the lowest self-perceived Internet skills with 50.0 percent of participants selecting fairly skilled or below, followed by white/Caucasian at 46.0 percent, Black/African American at 41.7 percent,

Asian/Pacific Islander at 40.9 percent, and last was Other at 40.0 percent. Of the participants who ranked themselves as experts, the participants that were most likely to rank themselves as experts were Other (10.0%), Black African American (8.3%), Hispanic (8.3%), Asian/Pacific Islander (7.5%), and last was Caucasian (5.5%) (See Table 4.1.10).

Post hoc comparisons using the Fisher LSD test revealed that there was no statistically significant difference between race/ethnicities by self-perceived Internet skills.

Table 4.1.10 Self-perceived Internet Skills and Race

Self-Perceived Internet Skills	Asian/Pacific Islander	Black/African American	Hispanic	White/Caucasian	Other	Total
	0	0	0	0	0	0
Not at all skilled	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(0.0%)	(0.0%)
Not very skilled	2 (2.2%)	1 (1.7%)	0 (0.0%)	11 (3.4%)	0 (0.0%)	14 (2.7%)
Fairly Skilled	36 (38.7%)	24 (40.0%)	12 (50.0%)	140 (42.7%)	4 (40.0%)	216 (41.9%)
Very Skilled	48 (51.6%)	30 (50.0%)	10 (41.7%)	159 (48.5%)	5 (50.0%)	252 (48.9%)
Expert	7 (7.5%)	5 (8.3%)	2 (8.3%)	18 (5.5%)	1 (10.0%)	33 (6.4%)

Men are more likely than women to perceive themselves to be competent users of technology (Madigan, Goodfellow & Stone, 2007; He & Freeman, 2010; Hargiatti & Shafer, 2006). Analysis of the demographics of gender and self-perceived Internet skills indicated that male participants were more likely than female participants to rate themselves as Expert (12.8% of male students vs. 4.5% of female students). The gap widens further when the Very Skilled and Expert ratings are combined; 67.5 percent of male participants and 51.7 percent of female participants rating themselves as Very Skilled or Expert (See Table 4.1.11).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences between self-perceived Internet skills by gender. Male participants were statistically more likely to select expert or very skilled than female participants

Table 4.1.11 Self-perceived Internet Skills and Gender

Internet Skills	Female	Male
	0	0
Not at all skilled	(0.0%)	(0.0%)
Not very skilled	12 (3.0)	2 (1.7%)
Fairly Skilled	180 (45.2%)	36 (30.8%)
Very Skilled	188 (47.2%)	64 (54.7%)
Expert	18 (4.5%)	15 (12.8%)

To investigate whether there was an effect of gender on self-perceived Internet skills, a Kruskal-Wallis H test was performed. Results showed statistical significance of gender on self-perceived Internet skills ($X^2 = 12.72$, $df = 1$, $p < 0.01$). It appears that male participants rated their self-perceived Internet skills higher than female participants.

4.2 Effect of Academic Discipline on Participants' Web-Use Skills

The primary hypothesis of this study examines the association between academic discipline and web-use skills among graduate and professional students at the University of Maryland, Baltimore. To investigate whether there was an effect of academic discipline on the web-use skills, a Kruskal-Wallis H test was performed. The results showed an effect of academic discipline on nine of the twenty-seven variables. There was statistical significance ($p < 0.01$) for the following variables: phishing, preference setting, reload, rss, tabbed browsing, tagging,

torrent, web feeds, and wiki (See Table 4.2.1). A full explanation of all dependent variables can be found in Table 3.2.2 in Chapter 3. A statistical significance of $p < 0.01$ rather than the conventional $p < 0.05$ was chosen to determine statistical significance. This was done to ensure that there were no false positives at $p < 0.05$.

Table 4.2.1 Effect of Academic Discipline on Participants' Web-Use Skills

Variable	X ²	p
Phishing	25.6608**	0.0001**
Preference Setting	16.2521**	0.0062**
Reload	24.1120**	0.0002**
RSS	27.3509**	<0.0001**
Tabbed Browsing	24.0732**	0.0002**
Tagging	15.5702**	0.0082**
Torrent	60.4725**	<0.0001**
Web feeds	15.5344**	0.0083**
Wiki	24.0524**	0.0002**

** = Significance < 0.01

The statistically significant difference for the variable Phishing appears to be due to the very high score of participants in the School of Pharmacy compared to the other academic disciplines. The academic discipline that appears to have the lowest score for the variable Phishing is the School of Nursing. Post hoc comparisons using the Fisher LSD test revealed that there were statistical significant differences between the School of Pharmacy and all other schools. In addition, there were statistically significant differences between the schools of Dentistry and the School of Nursing. There was no statistically significant difference between the schools of Law, Medicine, and Social Work.

For the variable Preference Setting, the statistically significant difference appears to be due to the difference between the School of Law and the School of Nursing. The School of Law appears to have the highest score, followed respectively by the School of Pharmacy, School of

Social Work, and School of Medicine. The academic disciplines that appear to have the lowest scores are the School of Dentistry, and the School of Nursing. Post hoc comparisons revealed that there were statistically significant differences between the School of Law and the schools of Dental and Nursing. In addition, the School of Nursing was statistically different from all other schools except for the School of Dentistry. There was no statistically significant difference between the schools of Dentistry, Medicine, Pharmacy, and Social Work.

The statistically significant difference for the variable Reload appears to be due the difference between the schools of Law, Pharmacy, Medicine, and Social Work with the schools of Dentistry and Nursing. Although it appears that the School of Law had the highest score, there is a large gap between the two groups mentioned above. Post hoc comparisons revealed that there were statistically significant differences between the School of Law and the School of Social Work, and also the School of Dentistry and the schools of Law and Medicine. In addition, the School of Nursing was statistically different than all other schools. There was no statistically significant difference between the schools of Medicine, Pharmacy, Social Work, and Law.

For the variable RSS, the statistically significant difference appears to be between the School of Law and the School of Nursing. The School of Law appears to have the highest score followed by the School of Medicine, and the School of Pharmacy. The academic discipline with the lowest score appears to be the School of Nursing. Post hoc comparisons revealed that the schools of Nursing and Social Work were statistically different than the schools of Law, Medicine, and Pharmacy. In addition, the School of Dentistry was statistically different than the School of Law. There was no statistically significant difference between the schools of Law, Medicine, and Pharmacy.

The statistically significant difference for the variable Tabbed Browsing appears to be due to the difference between three groupings of academic disciplines. The School of Law appears to have the highest score, followed by the School of Medicine. The second grouping that appears to be made of the middle scorers are the schools of Pharmacy, Dentistry, and Social Work. The School of Nursing appears to be much lower than the other two groups and also appears to be the lowest score. Post hoc comparisons revealed that the School of Nursing was different than all other academic disciplines. In addition, it was found that the School of Social Work was statistically different than the schools of Law and Medicine, and also that the School of Dentistry was different than the School of Law. There was no statistically significant difference between the schools of Dentistry, Pharmacy, and Social Work.

For the variable Tagging, the statistically significant difference appears to be between the schools of Law, Pharmacy, Social Work, and Medicine and the schools of Pharmacy and Nursing. The first group of academic disciplines appears to have higher scores than the second group of academic disciplines. Post hoc comparisons revealed that the School of Nursing was different than all other schools except for the School of Dentistry. In addition, it was found that the School of Dentistry was different than the School of Law. There was no statistically significant difference between the schools of Law, Medicine, Pharmacy, and Social Work.

The statistically significant difference for the variable Torrent appears to be due to the difference between four groupings of schools. The schools of Pharmacy and Law appear to have the highest scores. The next highest groupings of schools are the schools of Dentistry, and Medicine. The School of Social Work appears to have the next highest score, and the school that appears to be significantly lower than the rest is the School of Nursing. Post hoc comparisons revealed that the academic disciplines of Nursing and Social Work are statistically different than

all other academic disciplines. In addition, it was found that the School of Medicine was different than the School of Pharmacy. There was no statistically significant differences between the schools of Dentistry, Law, and Pharmacy.

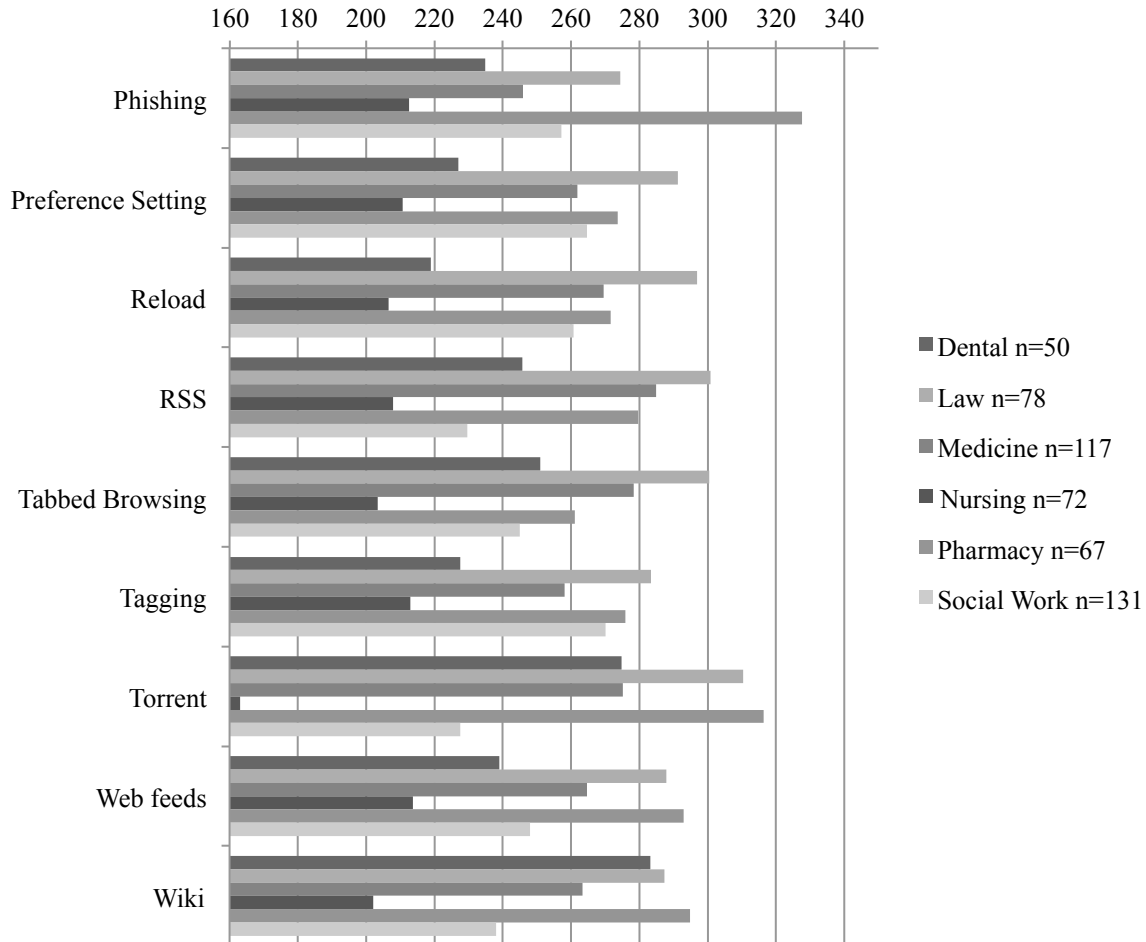
The statistically significant difference for the variable Web feeds appears to be due to the difference between three groups of schools. The schools of Pharmacy and Law appear to have scored the highest. They are followed by the schools of Medicine, Social Work, and Dentistry with middle scores. The academic discipline that appears to have the lowest scores is the School of Nursing. Post hoc comparisons revealed that the School of Nursing was statistically different than the schools of Pharmacy, Law, and Medicine. In addition, it was found that the schools of Social Work and Dentistry were statistically different than the School of Pharmacy. There were no statistically significant differences between the schools of Law, Medicine, and Social Work.

The statistically significant difference for the variable Wiki appears to be due to the difference between three tiers of scores. The schools of Pharmacy, Law, and Dentistry appear to have had the highest scores. They are followed by the schools of Medicine and Social Work with the middle scores. The academic discipline that appears to have the lowest scores is the School of Nursing. Post hoc comparisons revealed that the School of Nursing was statistically different than all other academic disciplines. In addition, it was found that the School of Social Work was statistically different than all other academic disciplines except for the School of Medicine. There was no statistically significant difference between the schools of Dentistry, Law, Medicine, and Pharmacy.

Looking at the data as a whole and examining the average rank sum for the six academic disciplines, it appears that participants in the School of Law have the highest score, followed closely by the schools of Pharmacy and Medicine. The next group of middle scorers appears to

be from the School of Social Work and the School of Dentistry. The lowest scores appear to be from the School of Nursing (See Graph 4.2.1).

Graph 4.2.1 Effect of Academic Discipline on Participants' Web-Use Skills



Note for Graph 4.2.1: This graph charts the average rank sum of each significant dependent variable by academic discipline and serves as an indicator of performance.

4.3 Effect of Gender on Participants' Web-use Skills

Previous research has found that gender is associated with web-use skills (Hargittai, 2010; Hargittai & Hinnant, 2008). To investigate whether gender affected the web-use skills of

the graduate and professional participants in this study, a Kruskal-Wallis H test was performed. The results showed an effect of academic discipline on eighteen of the twenty-seven variables. There was statistical significance ($p < 0.01$) for the following variables: cache, firewall, frames, jpg, malware, newsgroup, phishing, podcasting, preference setting, reload, rss, spyware, tabbed browsing, torrent, web feeds, web log, widget, and wiki (See Table 4.3.1).

Table 4.3.1 Effect of Gender on Participants' Web-use Skills

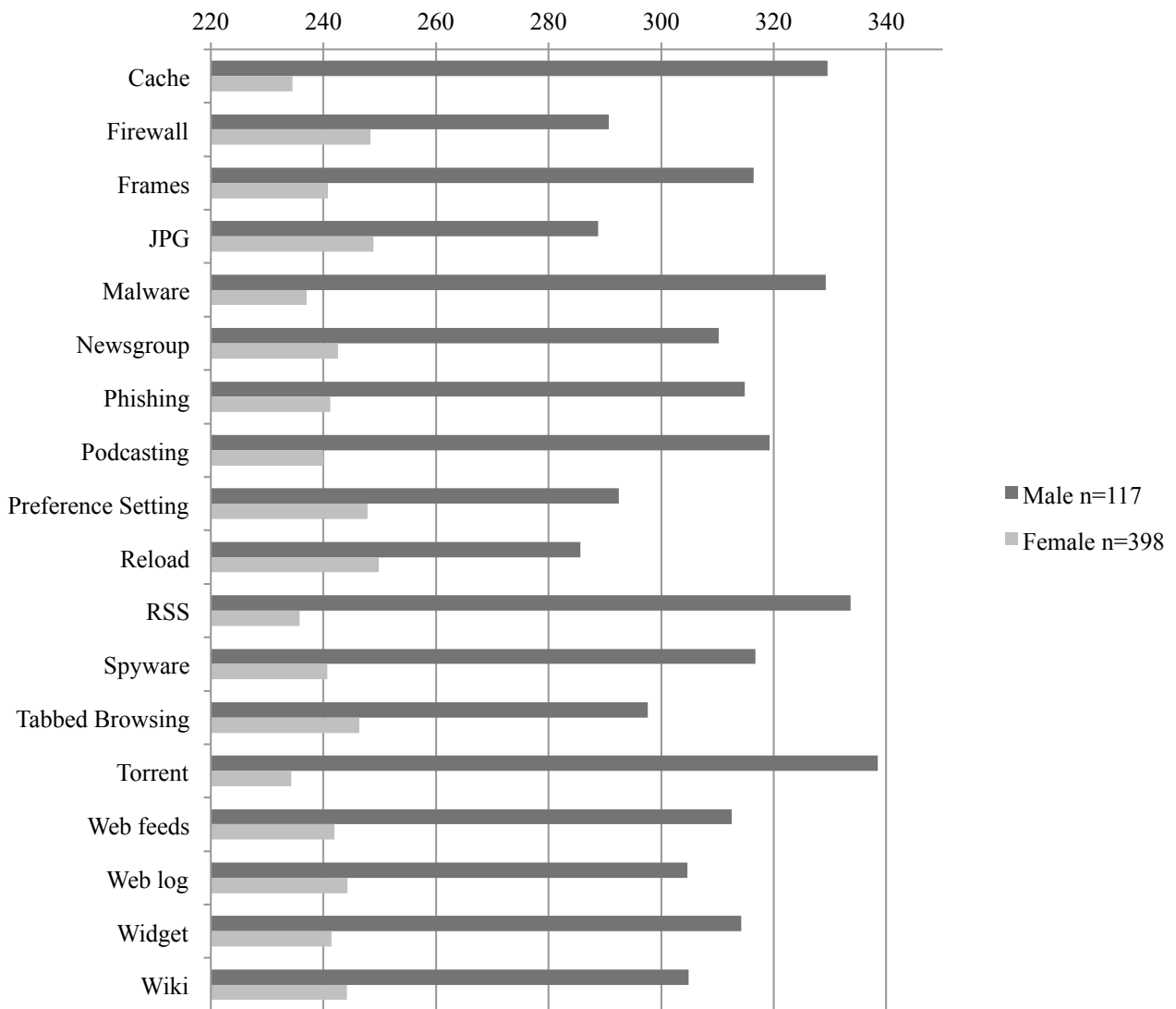
Variable	X ²	p
Cache	45.8611**	<0.0001**
Firewall	7.7373**	0.0054**
Frames	27.4477**	<0.0001**
JPG	7.2731**	0.0070**
Malware	36.9068**	<0.0001**
Newsgroup	19.8874**	<0.0001**
Phishing	23.3779**	<0.0001**
Podcasting	28.1906**	<0.0001**
Preference Setting	9.1409**	0.0025**
Reload	6.7639**	0.0093**
RSS	42.9096**	<0.0001**
Spyware	24.9927**	<0.0001**
Tabbed Browsing	13.2446**	0.0003**
Torrent	47.1219**	<0.0001**
Web feeds	21.1900**	<0.0001**
Web log	15.5391**	<0.0001**
Widget	22.5172**	<0.0001**
Wiki	17.0278**	<0.0001**

** = Significance > 0.01

It appears male participants outscored female participants on every variable. Comparing male participants' scores against themselves, the variables they are most familiar with are Cache, Malware, RSS, and Torrent. After examining the average rank sum for the two genders, it appears that male participants have a higher average rank sum than female participants for every

variable (See Graph 4.3.1). No post hoc comparisons were completed since in this instance there are only two independent variables and it is clear where the statistical significance occurs.

Graph 4.3.1 Effect of Gender on Participants' Web-use Skills



Note for Graph 4.3.1: This graph charts the average rank sum of each significant dependent variable by gender and serves as an indicator of performance.

4.4 Effect of Race/Ethnicity on Participants' Web-use Skills

Previous research (Hargittai, 2010; Hargittai & Hinnant, 2008) has found that race affects web-use skills. To investigate whether there was an effect of race/ethnicity on web-use skills, a Kruskal-Wallis H test was performed. The results showed an effect of race/ethnicity on ten of the twenty-seven variables. There was statistical significance ($p < 0.01$) for the following variables: bookmarklet, cache, frames, phishing, rss, social bookmarking, torrent, web log, widget, and wiki (See Table 4.4.1).

Table 4.4.1 Effect of Race/Ethnicity on Participants' Web-use Skills

Variable	X ²	p
Bookmarklet	13.8133**	0.0079**
Cache	15.8139**	0.0033**
Frames	20.0218**	0.0005**
Phishing	13.3382**	0.0097**
RSS	24.1014**	<0.0001**
Social Bookmarking	16.654**	0.0023**
Torrent	33.5043**	<0.0001**
Web log	18.8608**	0.0008**
Widget	14.3999**	0.0061**
Wiki	14.8761**	0.005**

** = Significance < 0.01

The statistically significant difference for the variable Bookmarklet appears to be due to the differences between Asian/Pacific Islanders and African American participants compared to Hispanic, Caucasian, and Other participants. The first group mentioned appears to have much higher scores than the second group. Post hoc comparisons revealed that Caucasian participants were statistically different than both Asian/Pacific Islander and African American participants. There was no statistically significant difference between Asian/Pacific Islanders, African Americans, Hispanic, and Other participants.

For the variable Cache, the statistically significant difference appears to be due to the difference between Other and Asian/Pacific Islander participants compared to African American, Caucasian, and Hispanic participants. The first group mentioned appears to have much higher scores than the second group. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than African American, Hispanic, and Caucasian participants. In addition, there was a statistically significant difference between Caucasian and Other participants. There was no statistically significant difference between African Americans, Hispanic, and Caucasian participants.

The statistically significant difference for the variable Frames appears to be due to the differences between Asian/Pacific Islanders and Other participants compared to Hispanic, Caucasian, and African American participants. The first group mentioned appears to have much higher scores than the second group. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than both African American and Caucasian participants. There was no statistically significant difference between African Americans, Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable Phishing appears to be due to the difference of three groups; 1) Asian/Pacific Islander participants, 2) African American and Caucasian and 3) Hispanic and Other participants. The first group mentioned above appears to have the highest scores, followed by the second group. The lowest scores appear to come from the participants that identify as Hispanic or Other. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than all other groups. There was no statistically significant difference between African Americans, Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable RSS appears to be due to the difference of three groups; 1) Asian/Pacific Islander participants 2) Other and 3) Caucasian, African American and Hispanic participants. The first group mentioned above appears to have the highest scores, followed by the second group. The lowest scores appear to come from the participants that identify as Caucasian, African American and Hispanic. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than African American, Hispanic, and Caucasian participants. There was no statistically significant difference between African Americans, Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable Social Bookmarking appears to be due to the differences between the Asian/Pacific Islanders and African Americans compared to Caucasian, Hispanic, and Other participants. The first group mentioned appears to have higher scores than the second group. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than Hispanic and Caucasian participants. In addition, there was a statistically significant difference between African American and Caucasian participants. There was no statistically significant difference between Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable Torrent appears to be due to the differences between each of the dependent variables. Asian/Pacific Islander participants appeared to score the highest followed by Other, Caucasian, and African American participants. The group that appears to have the lowest scores are Hispanic participants. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than African American, Hispanic, and Caucasian participants. There was no statistically significant difference between African American, Hispanic, Caucasian, and Other participants.

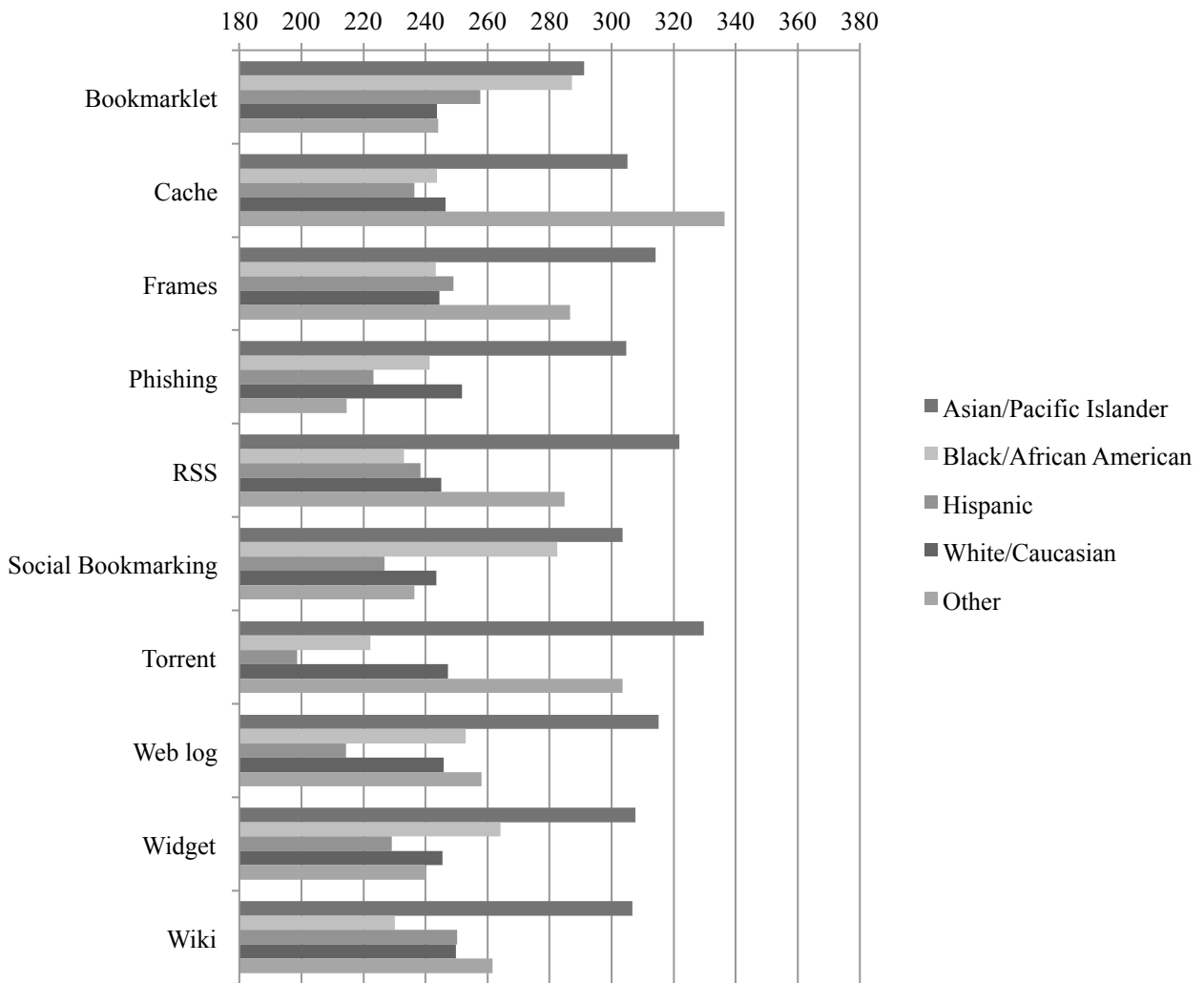
The statistically significant difference for the variable Web log appears to be due to the difference of three groups; 1) Asian/Pacific Islander participants 2) African American, Caucasian, and Other and 3) Hispanic participants. The first group mentioned above appears to have the highest scores, followed by the second group. The lowest scores appear to come from the participants that identify as Hispanic. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than African American, Hispanic, and Caucasian participants. There was no statistically significant difference between African American, Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable Widget appears to be due to the differences between the Asian/Pacific Islanders compared to African Americans, Caucasians, Hispanic, and Other participants. The first group mentioned appears to have higher scores than the second group. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than Hispanic and Caucasian participants. There was no statistically significant difference between African American, Hispanic, Caucasian, and Other participants.

The statistically significant difference for the variable Wiki appears to be due to the difference of three groups; 1) Asian/Pacific Islander participants 2) Other, Caucasian, and Hispanic and 3) African American participants. The first group mentioned above appears to have the highest scores, followed by the second group. The lowest scores appear to come from the participants that identify as African Americans. Post hoc comparisons revealed that Asian/Pacific Islander participants were statistically different than both African American and Caucasian participants. There was no statistically significant difference between African American, Hispanic, Caucasian, and Other participants. In addition, there was no statistically significant difference between Asian/Pacific Islander, Hispanic, and Other participants.

Looking at the data as a whole and examining the average rank sum for the five race/ethnicities, it appears Asian/Pacific Islander participants have a highest average rank sum followed by Other, African American, and Caucasian. The lowest scores appear to be from Hispanic participants (See Graph 4.4.1).

Graph 4.4.1 Effect of Race/Ethnicity on Participants’ Web-use Skills



Note for Graph 4.4.1: This graph charts the average rank sum of each significant dependent variable by race/ethnicity and serves as an indicator of performance.

4.5 Effect of International Status on Participants' Web-use Skills

UMB's international population makes up 4 percent of the total population and was included to explore whether international status had an effect on web-use skills. The results showed no significance for international status. Examination of the average rank sum for international and non-international participants indicates that international participants have higher scores. However the discrepancy in sample sizes (international students $n=14$, and non-international students $n=501$) prevents any meaningful analysis.

4.6 Effect of Parental Education on Participants' Web-use Skills

Parental education was included as a variable because it has been found to be related to academic achievement (Klebanov, Brooks-Gunn, & Duncan, 1994). To investigate whether there was an effect of parental education on web-use skills, a Kruskal-Wallis H test was performed on the data. The results showed no statistical significance for parental education for any of the twenty-seven variables ($p < 0.01$).

4.7 Effect of Self-Perceived Internet Skills on Participants' Web-use Skills

Since self-efficacy in general is related to actual behavior (Bandura, 2012), participants rated themselves on self-perceived Internet skills so effect of self-perceived skills on the Web-use Index could be investigated. In addition, self-efficacy with technology has been shown to be a significant predictor of a student's future academic and career path (Vekiri & Chronaki, 2008). The results showed significant differences on web-use skills by self-perceived Internet skills. All twenty-seven variables showed differences between levels of self-perceived Internet skills ($p < 0.01$) (See Table 4.7.1).

Table 4.7.1 Effect of Self-Perceived Internet skills on Web-use skills

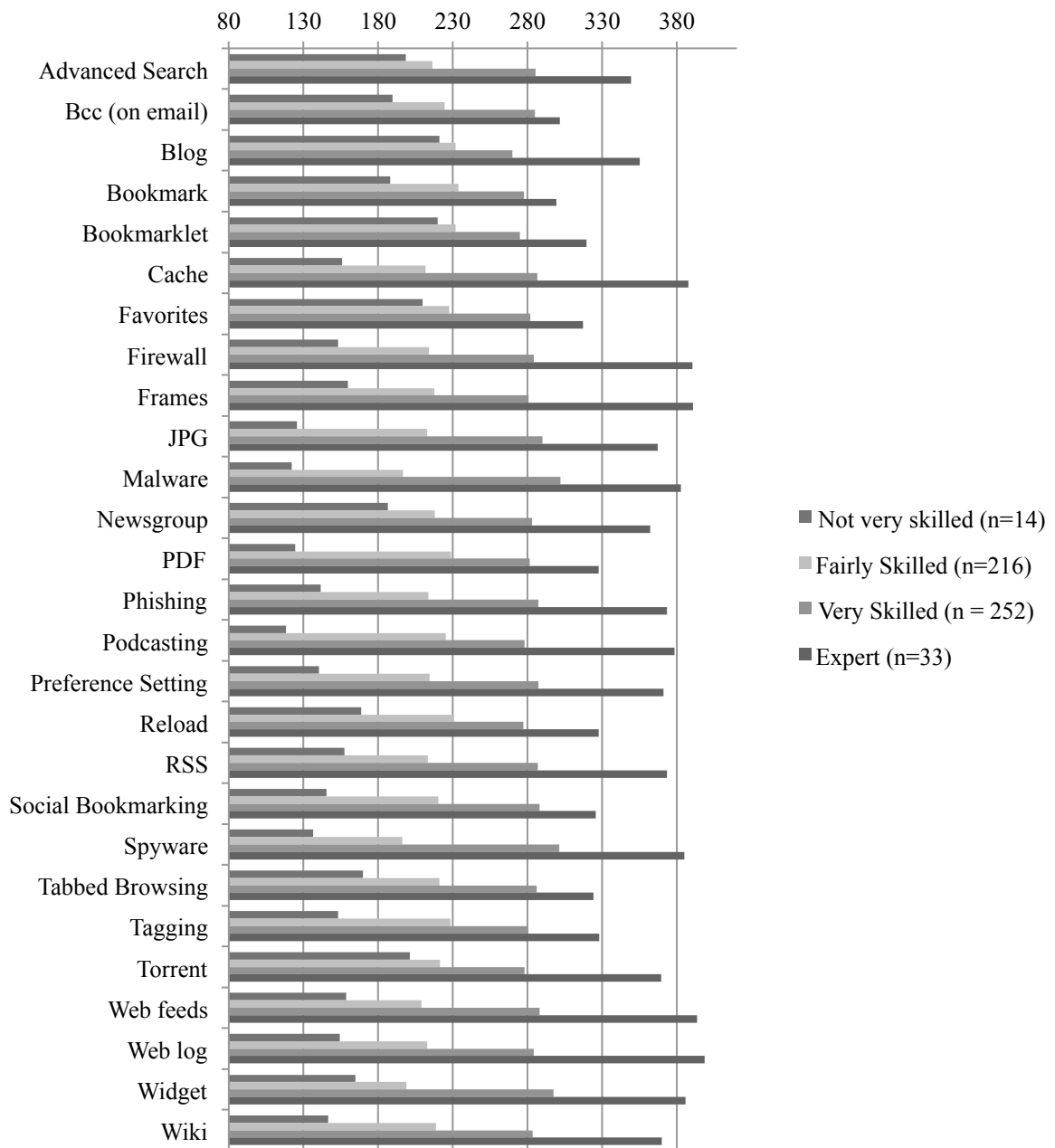
Variable	X ²	p
Advanced Search	45.5492**	<0.0001**
Bcc (on email)	36.0131**	<0.0001**
Blog	28.0229**	<0.0001**
Bookmark	25.3059**	<0.0001**
Bookmarklet	22.8090**	<0.0001**
Cache	64.3053**	<0.0001**
Favorites	38.7501**	<0.0001**
Firewall	63.3441**	<0.0001**
Frames	63.7130**	<0.0001**
JPG	67.3017**	<0.0001**
Malware	99.4009**	<0.0001**
Newsgroup	44.7808**	<0.0001**
PDF	46.7654**	<0.0001**
Phishing	60.5709**	<0.0001**
Podcasting	53.8669**	<0.0001**
Preference Setting	63.1594**	<0.0001**
Reload	30.6847**	<0.0001**
RSS	60.6044**	<0.0001**
Social Bookmarking	44.1324**	<0.0001**
Spyware	96.8400**	<0.0001**
Tabbed Browsing	41.4694**	<0.0001**
Tagging	34.6009**	<0.0001**
Torrent	40.5815**	<0.0001**
Web feeds	70.3792**	<0.0001**
Web log	67.0279**	<0.0001**
Widget	85.1277**	<0.0001**
Wiki	55.2737**	<0.0001**

** = Significance < 0.01

For every variable, participants that rated themselves as Expert appeared to score the highest, followed in order by Very Skilled, Fairly Skilled, and Not Very Skilled. The highest scorers were participants that rated themselves as Very Skilled, followed by Fairly Skilled, and Not very skilled. Post hoc comparisons using the Fisher LSD test revealed that all variables were statistically significant different from each other.

After examining the average rank sum for Internet skills, it appears that participants who rated themselves as Expert scored higher on the web-use skills index, followed in order by those who ranked themselves as Very Skilled, Fairly Skilled, and Not Very Skilled (See Graph 4.7.1).

Graph 4.7.1 Effect of Self-Perceived Internet skills on Web-use skills



Note for Graph 4.7.1: This graph charts the average rank sum of each significant dependent variable by self-perceived Internet skill and serves as an indicator of performance.

4.8 Effect of Age on Participants' Web-use skills

There is a perception that younger students born after 1982 are more digitally literate than older students (Prenski, 2001, Oblinger & Oblinger, 2005), although it has been refuted by recent literature reviews (Jones & Shao 2011; Bennett, Maton & Kervin, 2008). To investigate whether there was an effect of age on web-use skills, a Kruskal-Wallis H test was performed. The results showed significant differences between age groups for three of the twenty-seven variables ($p < 0.01$). These variables were tabbed browsing, tagging, and torrent (See Table 4.8.1).

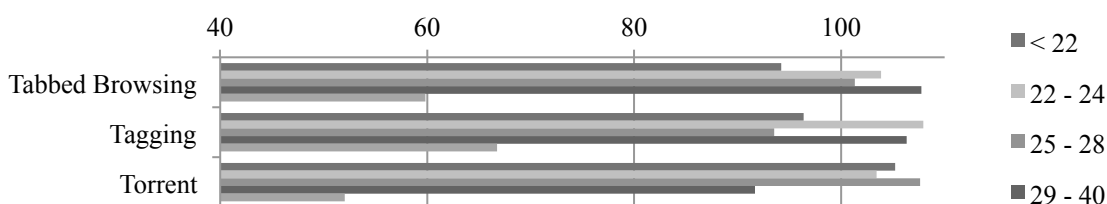
Table 4.8.1 Effect of Age on Web-use skills

Variable	X ²	p
Tabbed Browsing	22.2803**	0.0002**
Tagging	16.1171**	0.0029**
Torrent	30.8975**	<0.0001**

** = Significance < 0.01

The statistically significant differences for all three variables (Tabbed Browsing, Tagging, and Torrent) appear to be due to the difference between those under 40 years of age and those over 40 years of age. The lowest scores for those three variables appear to come from the participants that are greater than 40 years of age (See Graph 4.8.1). Post hoc comparisons using the Fisher LSD test revealed that for all variables, the statistically significant difference was between those 39 and younger, and those over 40 years old.

Graph 4.8.1 Effect of Age on Web-use skills

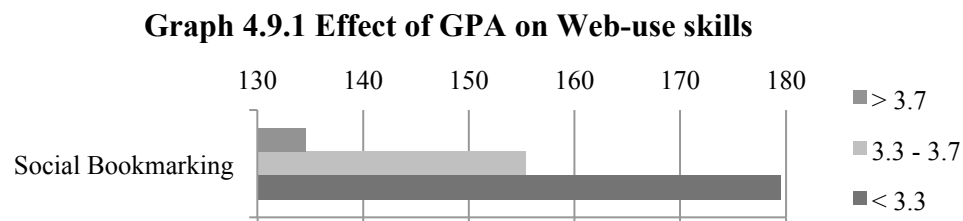


Note for Graph 4.8.1: This graph charts the average rank sum of each significant dependent variable by age and serves as an indicator of performance.

4.9 Effect of GPA on Participants' GPA

GPA was assessed as a proxy for academic achievement, although it is noted that there is variation in GPA by academic discipline. The results showed statistically significant differences for GPA. Only one of the twenty-seven terms variables showed differences between GPA ($p < 0.01$): social bookmarking ($X^2 = 13.65$, $df = 2$, $p < 0.001$).

Post hoc comparisons using the Fisher LSD test revealed that there were statistically significant differences for the variable social bookmarking between GPAs over 3.7 and GPAs under 3.3. The statistically significant differences for the variable Social Bookmarking appear to be due to the differences between all three groups. The lowest scores for Social Bookmarking appear to be from participants with GPAs greater than 3.7, the middle scores are from those with GPAs between 3.3 – 3.7, and the highest scores are from those with GPAs lower than 3.3 (See Graph 4.9.1).



Note for Graph 4.9.1: This graph charts the average rank sum of each significant dependent variable by GPA and serves as an indicator of performance.

CHAPTER V

DISCUSSION

5.1 Summary of Results

The primary purpose of the study was to examine whether academic discipline was associated with web-use skills among the graduate and professional students at the University of Maryland, Baltimore. Although there is a growing body of literature about the digital literacy of undergraduate students, there has been little, if any, research completed on the population of graduate and professional students. Graduate and professional disciplinary communities have been described as tribes or territories because their unique cultures make their academic communities different from each other (Becher, 1989; Becher & Trowler, 2001). Each academic disciplinary community has its own unique identity, which influences how students are educated, trained, and socialized. Because of the unique academic disciplinary identity and characteristics of graduate students, academic discipline should be examined when striving to understand the digital literacy of graduate students.

When comparing web-use skills across the different disciplines, significant statistical difference was found for nine of the twenty-seven web-use variables. There were statistically significant differences ($p < 0.01$) for the following variables: phishing, preference setting, reload, rss, tabbed browsing, tagging, torrent, web feeds, and wiki. It appears that the School of Law had the highest web-use scores, followed closely by the School of Pharmacy and the School of Medicine. Mid-range scores appeared to be from the School of Social Work and the School of Dentistry respectively. The lowest scores appeared to be from the School of Nursing.

The secondary purpose of the study was to investigate how age, gender, race, parental education, international status, GPA, and self-perceived skills are related to web-use skills. Based on trends in the literature, it was hypothesized that Asian/Pacific Islander and White/Caucasian participants would score higher than Black/African American, Hispanic, and Other race/ethnicities. Race/ethnicity had an effect on web-use skills on ten of the twenty-seven variables. There was statistical significance ($p < 0.01$) for the variables bookmarklet, cache, frames, phishing, rss, social bookmarking, torrent, web log, widget, and wiki. For the sample investigated in this study, Asian/Pacific Islander students have the highest scores followed by Other, African American, and Caucasian students. Hispanic students had the lowest scores.

The effect of age on web-use skills was minimal, with only three of the twenty-seven variables showing statistically significant differences between age groups. Age was statistically significant for the variables tabbed browsing, tagging, and torrent. The statistically significant differences for all three of these variables appear to be due to the difference between those under 40 years of age and those over 40 years of age. The lowest scores for those three variables appear to come from the participants that are greater than 40 years old.

Another purpose of the study was to investigate whether male participants would perceive themselves to be more competent users of technology and have higher web-use skills than female participants. Gender was statistically significant for eighteen of the twenty-seven variables. The statistically significant variables included cache, firewall, frames, jpg, malware, newsgroup, phishing, podcasting, preference setting, reload, rss, spyware, tabbed browsing, torrent, web feeds, web log, widget, and wiki. The findings suggest that women indeed have lower web-use skills than men and, in addition, rate themselves as less competent Internet users

then men. It appears that male participants outscored female participants on every variable, even for those that did not show statistically significant differences.

Next, it was found that parental education did not have a statistically significant effect on the Web-use Index scores for graduate and professional students. This finding differs from prior research results regarding undergraduates, which found that undergraduate students with at least one parent with a graduate degree exhibit a much higher knowledge about the Internet (Hargittai, 2010). Although the effect of parental education on web-use skills has been studied with undergraduates, the last two independent variables, international status and GPA, have not. For GPA there was a statistically significant difference for only one of the twenty-seven variables; social bookmarking. The statistically significant differences for the variable Social Bookmarking appears to be due to the differences between all three age categories. The lowest scores for Social Bookmarking appear to be from participants with GPAs greater than 3.7, the middle scores are from those with GPAs between 3.3 – 3.7, and the highest scores are from those with GPAs lower than 3.3. The significant variable appears to show an inverse relationship of GPA to web-use skills. Finally, in this study the results showed the effect of international status on web-use skills had no statistically significant differences for any of the variables.

5.2 Limitations

There are some notable limitations of the study that may have implications for the interpretation and generalizability of results. First, caution should be used when generalizing the results beyond graduate and professional students. The population at large of graduate and professional students is already a relatively privileged group since all have completed undergraduate degrees and are in the process of completing advanced degrees. These findings

may be applicable to graduate students but not to the population at large or undergraduate students.

Also, the findings of the study were based on an indirect assessment of skill that is a proxy for actual skill. Although the scores on the Web-use Index correlate with actual skill (Hargittai, 2005; Hargittai & Hsieh, 2012), it would be ideal if the assessment were a direct assessment instead of relying on a proxy to demonstrate a relationship. Direct measures are tangible and self-explanatory evidence of what students know. Conversely, indirect measures reveal characteristics associated with learning, but at best they imply that knowledge is attained and is less clear and less convincing than direct evidence (Suskie, 2009).

5.3 Discussion and Implications

If you use Biglan's model (1973) to group the academic disciplines, they fall into three categories. The Schools of Medicine, Pharmacy, Dentistry, and Nursing are applied, hard, and life disciplines. Social Work is a pure, soft, life discipline, and Law is an applied, soft, and non-life discipline. Based off of this framework, it was hypothesized that these different disciplines at UMB may be associated with varying levels of digital literacy skills. Similarities and dissimilarities between academic disciplines were observed, but did not appear to fall along the lines of Biglan's model. For example, even though they were in the same Biglan classification, participants at the schools of Nursing and Dentistry appeared to have the lowest scores while participants from the schools of Pharmacy and Medicine had some of the highest.

After reviewing the effects of other independent variables on web-use skills, specifically gender and race, it could be argued that those variables may have stronger associations with varying levels of web-use skills than academic discipline. That said, the effect of gender and race

does not explain all variations of web-use skills among the different academic disciplines. If gender and race were the only influential variables, then the schools of Nursing and Social Work would have the lowest scores due to both having the highest percentage of female participants, and the lowest percentage of Asian/Pacific Islander participants. Although they were both in the bottom three, the School of Dentistry also joined them even though it had the lowest percentage of female participants and the second highest percentage of Asian/Pacific Islander participants. Solely in the lens of gender and race, one could hypothesize that Dental participants would have some of the highest scores. Instead, the School of Dentistry had the second lowest web-use scores. This anomaly cannot be explained by gender and race alone, and it appears that the academic discipline the participant is enrolled in is associated with varying levels of web-use scores.

Why would students in different academic disciplines have varying levels of web-use skills? Graduate and professional disciplinary communities have been described as tribes or territories because their unique cultures make their academic communities different from each other (Becher, 1989; Becher & Trowler, 2001). Differences between disciplines include research and publications, career paths, symbols of identity, and student training (Clark, 1999). Students may self-select to go to different academic disciplines based on innate abilities, strengths, or cultural preferences. These differences may contribute to varying levels of web-use skills.

In addition, some academic disciplines are more likely to use information and communication technology (ICT) in the academic curriculum (Weng & Ling, 2007). Research cultures such as the pure, hard disciplines of science and health science are more likely to strategically incorporate the use of ICT into their fields (Fry, 2004), while soft disciplines in the social sciences are more likely to incorporate ICTs in an as needed and localized manner (Fry,

2006). In addition, further studies have found differences in academic discipline by technology acceptance (Orji, 2010) risk perception of technologies (Weisenfeld & Ott, 2010), and general use of technology (Guidry & BrckaLorenz, 2010). Perhaps the differences in web-use skills can be attributed to the type or execution of ICT in the classroom, or students' academic experience or comfort with technology. Future research should investigate how differing cultures and ICT use affects digital literacy among academic disciplines.

Most of the literature about digital literacy has focused on the skills and abilities of undergraduate students. The lack of research on graduate and professional students has been attributed to a belief that graduate students have adequate skills because they have advanced through an undergraduate experience (O'Donnell et al., 2009). Graduate students are not only underrepresented in the literature, but there is an assumption that they have already gained the skills that they need to successfully navigate technology. In addition, the specificity of the education of graduate and professional students may exclude training or emphasis on digital literary skills, or operate under the assumption that graduate level learners are already digitally literate. When you combine this knowledge with the un-evidenced claim that digital natives have inherent technological ability, you can see how the assumption that graduate students are tech savvy becomes even more pronounced.

Results from this study find that like undergraduate students, graduate students have a variety of digital skill levels and that these skill levels are more influenced by other demographic factors other than age. Age did have a small relationship with digital literacy, but only with variables that represent newer technology advances catering towards younger adults. An example of this is sharing files through torrents, used more frequently by undergraduate students than older adults (Jones et al., 2009). Findings from this study support other research (Jones & Shao,

2011; Kennedy et al., 2007; 2008; Bennet & Maton, 2010) that today's students are not a single group or generation with common characteristics, but instead have varying skill levels.

It was hypothesized that GPA would be positively related with digital literacy skills. In this study, this was not found to be the case. The one statistically significantly different variable, social bookmarking, actually showed an inverse relationship between skill and GPA. This may be due to the variety of grading scales and curriculums used by the different academic disciplines. The outcome may have been different if the GPAs of participants were compared within a particular academic discipline or school, instead of comparing academic disciplines against each other.

Prior research indicates that the socioeconomic factors of parental education, gender, and race affect the digital literacy of undergraduate students (Hargittai, 2010). Results from this study found that while gender and race affected the digital literacy of graduate and professional students, parental education did not. This finding marks an interesting difference between graduate and undergraduate students and is a unique contribution to the literature. The socioeconomic advantage of parental education does not seem to affect graduate or professional students in the same way it affects undergraduate students. The findings suggest that at some point, students outgrow the impact of their parents' education. The students who do not outgrow their parents' impact may be less likely to end up in graduate school. Goldin and Katz (2008) found that the highly educated are able to keep up with advancements in technology and increase their lead over people in lower socioeconomic classes. Also, more education is characterized by higher levels of computer ownership, spending more time online, and more availability of Internet access (DiMaggio et al., 2004) all of which are associated with higher web-use skills. It can be hypothesized that since participants of the study are already in graduate

or professional school, the effect of the socioeconomic advantage of their parents' education on web-use skills has been offset.

Although the level of students' education appears to negate the effect of parental education, it does not negate the effect gender has on web-use skills. Examining the results in closer detail, gender plays a larger role in the digital literacy of graduate and professional students than other demographic factors. The results of this study found that men scored higher on the Web-use Index and perceived themselves to be more competent users of technology than women. This may be due to a plethora of factors influenced by gender including family life, self-efficacy, and access and use of technology (McMillan & Morrison, 2006; Correa, 2010; Hargittai & Hinnant, 2008; Hassani, 2006; Livingstone & Helsper, 2007).

Beginning with family life, research by McMillan & Morrison (2006) suggests that the family environment can reinforce gender stereotypes related to Internet use. McMillan & Morrison (2006) found that generally, mothers were less likely to use communication technology while fathers displayed more Internet use and proficiency. Daughters mirror the gender roles displayed by their mothers, and this has the ability to contribute to stereotypes surrounding women and their Internet use. In addition, men have been found to have more positive attitudes towards the Internet than women (Sherman et al., 2000; Slate et al., 2002; Zhang, 2002).

In this study, higher self-perceived Internet skills were positively related with higher web-use skills. This variable is important because participants' self-perceived skills are not always positively related with actual skill. Some studies have found that male students rate their self-perceived skills higher and actually score higher (Hargittai, 2010), but other studies found that men have higher levels of self-perceived web-use skills than women despite similarities in

actual skill (Hargittai & Shafer, 2006; Madigan, Goodfellow, & Stone, 2007). In this study, men both rated their self-perceived Internet scores higher, and scored higher on the Web-use Index.

He and Freeman (2010) completed a study on web use and gender and their results suggest female students were found to have less computer knowledge and fewer computing experiences than their male counterparts. Men are also more likely to have more technology classes in school, more computers in the home in which they grew up, and a personal computer in their own room (Correa, 2010). These factors may contribute to male participants' higher scores in this study. Future research should examine attitudes and perceptions as they relate to technology use and gender of graduate and professional students.

Second to gender, race had the second highest effect on web-use skills. The findings that Asian/Pacific Islander students had the highest web-use skills and Hispanic students had the lowest support those of Hargittai and Hinnant (2008), who found that Asian American students used the web more than other groups regardless of resources or experience, and that students of Hispanic origin report knowing less about the Internet. Asian/Pacific Islanders experience similar prejudice and discrimination encountered by other minority groups (Sue, 1981), but yet in this study had the highest scores on the Web-use Index. Why could that be? Many studies have investigated the high achievement of Asian/Pacific Islander students. While some studies emphasize selective immigration (Hirschman and Wong, 1986), the most widely accepted explanation involves the integration of cultural values that promote academic excellence (Sue & Obazaki, 1990). Some examples of cultural values embodied in Asian American culture that have been identified as promoting educational success are the importance of hard work, respect for education, and high expectations for achievement (Kitano, 1984; Sue & Okazaki, 1990). In addition, family socialization has been proposed as a major factor for transmitting cultural

values, and contributing to Asian American students' academic success (Mordkowitz & Ginsburg, 1987).

In addition, research has found that students, who hold beliefs that their skills are less, tend to believe that success and intelligence is innate and unable to be changed (Komarraju & Nadler, 2013). On the other hand, those students who have a higher self-image outperform others because they are able self-regulate their impulses and persist when faced with a difficult situation (Komarraju & Nadler, 2013). Those who possess higher self-efficacy and expectations for achievement are more likely to outperform others with lower self-efficacy (Beas & Salanova, 2006).

The high scores of Asian/Pacific Islander students does not depart from literature within the study of digital literacy or academic achievement in general, but other findings from this study about the impact of race were unanticipated. Perhaps the most surprising was the finding that African Americans scored higher than Caucasian students on the Web-use Index. The gap in academic achievement between African Americans and white Americans has been studied extensively (Rothstein & Wozny, 2011). The literature surrounding this topic could easily create the basis for another thesis (or three or four). To summarize, there is a gap in the academic achievement of black and white students. This is impacted by many factors including but not limited to income, schooling, wealth (Jencks & Phillips, 1998; Hill 2001), household composition (Astone & McLanahan, 1991), perceived teacher support (Hayes, 2011), parental involvement (Rosenblatt & Peled, 2002), school environment (Webster, 2004), and parental educational aspirations (Overstreet et al., 2005).

Moving from the gap in academic achievement and specifically delving into digital literacy, the finding from this study is contrary to other findings regarding African American and

Caucasian students. In the literature, African American students report knowing less about the Internet (Hargittai, 2010) and have scored lower on tests measuring information and digital literacy (Sexton, Hignite, Margavio, & Margavio, 2009; Jackson et al., 2008; Ritzhaupt, Feng, Dawson, & Barron, 2013). What's also noteworthy is that in this study 93.3 percent of Black/African American participants were female. So although they scored higher than White/Caucasians overall, in this instance race may have had a larger impact than gender on web-use skills. Similar to the discussion surrounding parental education, it can be hypothesized that since participants of the study are already in graduate or professional school, the effect of the socioeconomic advantage or disadvantage of their race on web-use skills is offset.

Possible reasons for this finding could be that African American students in graduate school may have a higher socioeconomic status, higher quality of schooling, more parental support, or a better school environment. Future research should investigate the digital literacy of African American graduate and professional students to uncover why it deviates from the traditional academic achievement gap. Further studies of graduate and professional students may not confirm the results found in this study. Learning more about this subject has the potential to affect how this gap is addressed throughout the course of an individual's educational path, and not just as graduate and professional students.

The conversation surrounding the effect of gender and race is important in the context of digital inequality. DiMaggio et al. (2004) created a theoretical framework that highlights five aspects of inequality related to information and communication technologies: 1) the quality of hardware, software, and network connection, 2) autonomy of use, 3) skill, 4) availability of social support, 5) extent and quality of use. DiMaggio et al. (2004) proposed that demographic and socioeconomic factors influence the level and quality of the first four factors. This goes on to

influence the types of use, which then creates differentiated benefits and opportunities of use. Ultimately, this can contribute to differing life outcomes. Those who are more privileged are positioned to benefit more from the medium than those who are less privileged. Neglecting to address this gap in digital literacy between different genders and races may deepen secondary digital divides and disadvantage certain groups of people. Furthermore, it has been found that online abilities are related to a person's future socioeconomic status (Hargittai, 2002; Hargittai & Hinnant, 2008; Hargittai & Walejko, 2008). Not addressing these concerns has the potential to contribute to inequality. Future research should investigate how types of Internet use affect potential gains in human, financial, and social capital.

5.5 Conclusion

In light of the concern of demographic factors and their relationship with digital inequality, faculty, staff, and policy makers should take action by creating initiatives that address the digital literacy of graduate and professional students. This can be done by creating programs and initiatives that include aspects of DiMaggio et al. (2004)'s framework of digital inequality, particularly skill, availability of social support, and extent and quality of use. Skill addresses actual skill with technology. Extent and quality of use addresses the cognitive aspects of navigating technology and the ethical impacts of technology use. Social support addresses changing what is modeled in society and mentoring others. In the case of this study digital literacy was measured by evaluating web-use skills with Hargittai and Hsieh's Web Use Index (2010). This assessment falls under DiMaggio et al. (2004)'s domain of skill, but is narrow from a holistic standpoint of impacting digital inequality. Taking a wider lens and addressing more domains would require an integrated approach regarding education around digital competence.

To start with initiatives that address skill, it would be a useful practice to evaluate students' digital literacy skills upon or before entering graduate school. If students do not meet a designated skill threshold they should be required or encouraged to take a class or workshop addressing the skills needed to enhance their competency with technology. To do this at such a large scale, more affordable and accessible assessment tools should be developed with an emphasis on skills that are needed to be successful as a graduate or professional student. Likewise, it would be useful to also evaluate the digital literacy of faculty and staff upon joining the university and provide them with on-going support and training as needed. Also, faculty and staff that are engaged with technology should actively mentor students and/or their peers. This can be done informally through impromptu trainings or formally through an organized series of professional development opportunities.

Universities could offer a curriculum or co-curriculum of workshops or trainings to graduate and professional students that address general technological competence. Examples of workshops could include "Getting started with Zotero," "How to build a website when you don't know how to code" or "Cyberbullying and higher education" When designing these programs, it is important to emphasize actual technical skill with certain programs, but also address the cognitive and ethical aspects of digital literacy. As the volume of information available online expands, students will be challenged to search critically and evaluate information. A student's conceptual ability to adapt to new technology and navigate these changes will be paramount.

Also, future research should investigate bias in instruction. Educational materials to help educators to overcome bias exist, but often educators do not engage with these materials because they think themselves incapable of bias. Instead, activities should be facilitated with educators that help them uncover their own biases and how to be cognizant of those biases when teaching

and leading programs. Recognizing bias is essential to closing the skill gap for women and minorities.

From a societal and policy perspective, those that have the responsibility of communicating should start portraying those who work in technology driven fields differently, so that diverse and underrepresented groups can see themselves working and engaging with technology. Currently, the overwhelming image of technology is white, geeky men and this can discourage participation from diverse groups. Individuals form models of what is possible and acceptable when they see people like themselves inhabiting those roles. The achievements of women and diverse groups should be highlighted to encourage engagement with technology.

Moving from societal to social support, just as the popular *Girls on the Run* encourages girls to exercise and be active, programs that support young women's engagement and competency with technology should be advocated for. Girls tend to fall off the STEM bandwagon in sixth or seventh grade, so ideally this group would engage students before they reach that age. To address this, graduate and professional students in STEM fields could partner with local middle or elementary schools to encourage and empower young girls' participation in science and technology fields. In addition to technological competence, it is also important to address training or instruction regarding self-efficacy and technology. Self-efficacy with technology has been shown to be a significant predictor of a student's future academic and career path (Vekiri & Chronaki, 2008), and women have been shown to have higher levels of Internet anxiety and lower levels of technology self-efficacy than men (Sherman et al., 2000; Zhang, 2002; Slate et al., 2002; Hargittai & Shafer, 2006). Addressing Internet anxiety through role modeling or education has the potential to create a more comfortable environment where women will feel empowered to use technological tools.

In conclusion, the conversation surrounding the effect of gender and race is important in the context of digital inequality. Due to relationship of demographic factors and digital inequality, faculty, staff, and policy makers should take action by creating initiatives that address the skill and availability of social support for graduate and professional students. Not addressing these concerns has the potential to contribute to inequality.

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IV. APPENDICES

Appendix A: Instrument

Adapted from Hargittai, E. & Hsieh, Y.P. (2012). Succinct Survey Measures of Web-Use Skills
Social Science Computer Review. Bibliographic entry.

1. What is your age?
 - a. Write in
2. What is your classification?
 - a. Undergraduate student
 - b. Graduate student
 - c. Other (please specify)
3. What is your race and/or ethnicity? (select all that apply)
 - a. Asian/Pacific Islander
 - b. Black/African American
 - c. Hispanic
 - d. White/Caucasian
 - e. Other (Please specify)
4. Are you an international student?
 - a. Yes
 - b. No
5. What is the highest degree or level of school your parents have completed? *If currently enrolled, highest degree received.*
 - a. Some high school, no diploma
 - b. High school graduate/diploma or the equivalent
 - c. Some college credit, no degree
 - d. College degree
 - e. Graduate or professional degree
6. What school are you in?
 - a. Medicine
 - b. Pharmacy
 - c. Law
 - d. SSW
 - e. Nursing
 - f. Dental
 - g. Other, please specify
7. Is this your first semester at UMB?
 - a. Yes

- b. No

Skip logic: If a student answers “No” to question 7 they will be asked their GPA. If they answer “Yes” question 8 will be omitted. This is done because first semester students do not yet have GPAs.

- 8. What is your estimated GPA?
 - a. Write in
- 9. What is your gender?
 - a. Male
 - b. Female
 - c. Transgender
 - d. Other
- 10. In terms of your Internet skills, do you consider yourself to be...
 - a. Not at all skilled
 - b. Not very skilled
 - c. Fairly skilled
 - d. Very skilled
 - e. Expert
- 11. The purpose of this question is to assess your attentiveness to question wording. For this question please mark the Very often response.
 - a. Never
 - b. Rarely
 - c. Sometimes
 - d. Often
 - e. Very often
- 12. How familiar are you with the following Internet-related items? Please choose a number between 1 and 5 where 1 represents having “no understanding” and 5 represents having “a full understanding” of the item. Please do not Google to discover meaning. This is an anonymous survey and not an assessment of individual skill. [none, little, some, good, full]
 - a. Advanced search
 - b. Bcc (on email)
 - c. Blog
 - d. Bookmark
 - e. Bookmarklet
 - f. Cache
 - g. Favorites
 - h. Fitibly
 - i. Firewall
 - j. Frames

- k. JFW
- l. JPG
- m. Malware
- n. Newsgroup
- o. PDF
- p. Phishing
- q. Podcasting
- r. Preference setting
- s. Proxypod
- t. Reload
- u. RSS
- v. Social Bookmarking
- w. Spyware
- x. Tabbed Browsing
- y. Tagging
- z. Torrent
- aa. Web feeds
- bb. Weblog
- cc. Widget
- dd. Wiki

Appendix B: IRB Exemptions



Office of
Sponsored
Research

t: 410.837.6191
f: 410.837.5249
www.ubalt.edu

August 29, 2014

Jennifer Owens
IDIA
University of Baltimore
1420 N. Charles Street
Baltimore, MD 21201

Dear Ms. Owens:

This letter serves as official confirmation of the Institutional Review Board's review of your protocol for a study entitled "Do web use skills differ among graduate students in health science and human services professional programs?," submitted for review on July 29, 2014 and revised on August 28, 2014.

The Institutional Review Board considered your request and concluded that your protocol poses no more than minimal risk to participants. In addition, research involving the use of widely acceptable survey/interview procedures where the results are kept confidential and the questions pose minimal discomfort to participants is exempt from IRB full-committee review per 45 CFR 46.101 (b) (2). As a result, the Institutional Review Board has designated your proposal as exempt.

Investigators are responsible for reporting in writing to the IRB any changes to the human subject research protocol, measures, or in the informed consent documents. This includes changes to the research design or procedures that could introduce new or increased risks to human subjects and thereby change the nature of the research. In addition, you must report any adverse events or unanticipated problems to the IRB for review.

If you have any questions, please do not hesitate to contact me directly by phone or via email.

As authorized by Eric B. Easton, J.D., Ph.D.
Chair, Institutional Review Board

Marc P. Lennon
Coordinator, Institutional Review Board

cc: Dr. K. Summers

University of Baltimore
1420 N. Charles St.
Baltimore, MD 21201-5779



University of Maryland, Baltimore
 Institutional Review Board
 Phone: (410) 706-5037
 Fax: (410) 706-4189
 Email: hrpo@som.umaryland.edu

NOT HUMAN RESEARCH DETERMINATION

Date: September 12, 2014

To: Roger Ward
 RE: HP-00061038

This letter is to acknowledge that the UMB IRB reviewed the information provided and has determined that the submission does not require IRB review. This determination has been made with the understanding that the proposed project does not involve a systematic investigation designed to develop or contribute to generalizable knowledge **OR** a human participant (see definitions below).

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Definitions –

Human Research: Any activity that either:

- Is “Research” as defined by DHHS and involves “Human Subjects” as defined by DHHS (“DHHS Human Research”); or
- Is “Research” as defined by FDA and involves “Human Subjects” as defined by FDA (“FDA Human Research”).

Research as Defined by DHHS: A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

Research as Defined by FDA: Any experiment that involves a test article and one or more human subjects, and that meets any one of the following:

- Must meet the requirements for prior submission to the Food and Drug Administration under section 505(i) of the Federal Food, Drug, and Cosmetic Act meaning any use of a drug other than the use of an approved drug in the course of medical practice;
- Must meet the requirements for prior submission to the Food and Drug Administration under section 520(g) of the Federal Food, Drug, and Cosmetic Act meaning any activity that evaluates the safety or effectiveness of a device; OR
- Any activity the results of which are intended to be later submitted to, or held for inspection by, the Food and Drug Administration as part of an application for a research or marketing permit.

Human Subject as Defined by DHHS: A living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through Intervention or Interaction with the

individual, or (2) information that is both Private Information and Identifiable Information. For the purpose of this definition:

- Intervention means physical procedures by which data are gathered (for example, venipuncture) and manipulations of the subject or the subject's environment that are performed for research purposes.
- Interaction means communication or interpersonal contact between investigator and subject.
- Private Information means information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (for example, a medical record).
- Identifiable Information means information that is individually identifiable (i.e., the identity of the subject is or may readily be ascertained by the investigator or associated with the information).

Human Subject as Defined by FDA: An individual who is or becomes a subject in research, either as a recipient of the test article or as a control. A subject may be either a healthy human or a patient. A human subject includes an individual on whose specimen (identified or unidentified) a medical device is used.

Please keep a copy of this letter for future reference. If you have any questions, please do not hesitate to contact the Human Research Protections Office (HRPO) at (410) 706-5037 or HRPO@som.umaryland.edu.

Appendix C: Informed Consent

You are being asked to participate in a research project about Internet and web-use skills. Jenny Owens M.S., a staff member from Campus Life Services at the University of Maryland, Baltimore, is conducting this study.

This survey is anonymous. No one, including the researcher, will be able to associate your responses with your identity. Your participation is voluntary. You may choose not to take the survey, to stop responding at any time, or to skip any questions that you do not want to answer. You must be at least 18 years of age to participate in this study. Your completion of the survey serves as your voluntary agreement to participate in this research project.

The survey should take 5-15 minutes to complete. At the end of the survey, you may choose to provide an e-mail address to enter a drawing to win an iPad Mini. Only one student will win a prize.

Thank you for your participation and input. Questions regarding the purpose or procedures of the research should be directed to *Jenny Owens, M.S.* at (410) 706-4412 or jowens@umaryland.edu.