Attitudes, Beliefs and Behaviors of Academically Talented and Well-Abled Middle School Children in Their Use of the Internet

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ABSTRACT

Using the Internet as a source for learning is rapidly transforming how we work and live. Internet-savvy children are vigorously participating in this new activity – largely outside of the classroom. A better understanding of these students' attitudes, beliefs, and behaviors will help guide educators in making the necessary pedagogical changes to meet 21st century social, cultural, and economic change.

This study investigated the construct of *Internet-savviness* exhibited by academically talented and well-abled youth, ages eight through fourteen. Grounded in learning theories of social constructivism and distributed intelligence, a survey scale was developed to measure Internet-savviness and to elicit these children's Internet-related attitudes, beliefs, and behaviors. Reliability and validity analyses of the scales revealed satisfactory levels of internal consistency. An exploratory factor analysis revealed a clear, underlying structure of the following dimensions: 1) computer mediated communication, 2) creative expression, 3) information gathering, 4) Internet fluency, 5) Internet-self efficacy, and 6) social collaboration. ANOVA, MANOVA, and Regression analyses along with correlation and descriptive statistics analyses were applied to other variables of interest including Internet access speed, age, gender, frequency of Internet use, and type and location of access. Internet-savvy scores corresponded to self reports of *Beginner*, *Intermediate* and *Advanced* Internet users. Thirty-three percent of youth rated themselves as *Advanced* users which aligns with previous research on Internet-savvy teens. Although females and males differed in Internet activities and scored below males on Internet-savviness, they closed the gap by age 12. Regarding gender, there were no

statistical differences on dimension or total IS scores in this study. Doing something creative, exchanging images, access speed, age and access at home and at a friend's house were statistically significant predictors of IS scores. Effect sizes were reported. Narrative data was collected from the participants, analyzed, and summarized as a way to identify central themes regarding Internet use in and outside of school and to triangulate on the multidimensional nature of Internet-savviness.

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APPROVAL OF THE DISSERTATION

This dissertation, Attitudes, Beliefs and Behaviors of Academically Talented and Well-Abled Middle School Children in their Use of the Internet, has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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DEDICATION PAGE

This work is dedicated to my beloved wife, Mary, our two sons, Kane and Rory along with their wonderful wives, Heather and Shelby. Without their love and support, this meeting would not be taking place.

I also dedicate this work to my brother, George, whose courage, strength dedication, loyalty, and perseverance I greatly admire.

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Life is an adventure; long may she run . . .

rwg

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CHAPTER 1

INTRODUCTION

It is the supreme art of the teacher to awaken joy in creative expression and knowledge.

Albert Einstein

Overview

This study explores the characteristics of a group of technologically elite youth who use the Internet for most everything they do. A survey instrument was developed to test and measure the construct of *Internet-savviness* and its underlying dimensions. The relationships between these factors and other variables of interest are also explored in order to better understand how educators can instructionally exploit the rapid changes taking place and the intense motivation most children have while engaging and using the Internet. A realization that has emerged from this study is that longstanding activity-based cognition and learning theories have become more operationalized in today's distributed, networked environment. The processes that embody and enable individual knowledge creation, synthesis and application have become scalable across groups of individuals and artifacts in a globally connected landscape. Nowhere are these processes and transformations more in evidence than in the attitudes, beliefs and behaviors of *Internet-savvy* children.

Having grown up with technology as an integral part of their lives, many teens are deeply immersed in an increasingly complex and distributed culture of computing and video gaming (Prensky, 2001). They use technology and its tools to engage, extend, interact with, play, and explore an increasingly complex world in order to give it meaning. A small but growing group of adolescents have become intrepid explorers of the Internet and all that it offers. They have become unintentional and unknowing participants in a series of global transformations that presage significant, disruptive change in our society and in particular, in how we teach and learn in our schools.

A rapidly evolving, knowledge based global economy combined with "always on" digital communication and resource access has radically transformed the value of what, when, where, and how people learn. Although Peter Drucker (1959) first coined the term "knowledge worker" almost 50 years ago, the creation and value of intellectual capital, from individual entrepreneurs to large multinational corporations, has greatly increased in a 24/7, connected world. These changes are profound and have occurred fairly recently. In his book, *The World is Flat*, Thomas Friedman (2004) referred to this new era as "Globalization 3.0," beginning around 2000. The unique character of this recent shift is the individual's newly formed capacity to create new knowledge, collaborate, and compete globally. As Friedman pointed out, "Individuals must, and can now ask, where do I fit into the global competition and opportunities of the day, and how can I, on my own, collaborate with others globally?" (p. 10). On a macro level, developing countries, rich intellectually but poor economically, are reaching a kind of technological critical mass and wielding their knowledge capital in a very competitive way. In the post-industrial world, outsourcing takes on new meaning in the lexicon of a

digital, connected environment where low-cost/high skills requirements are met in a global marketplace. One real fear is that highly paid, knowledge-based jobs will follow the same path as U.S. manufacturing – only more quickly (Congressional Budget Office, 2004). In an article about General Motors and China for *Fast Company* magazine, Fara Warner (2007) asked, "Americans have become comfortable with the notion that our competitive advantage – innovative energy and smarts – can't be outsourced. But what if it isn't true?" For the first time ever, a Chinese team of GM designers will design the next Buick *LaCrosse*, due out at the end of the decade, for the entire world (p. 72).

Business leaders understand the linkage between an educated and highly trained workforce and the ability to survive and thrive in this kind of marketplace. According to Karoly and Panis (2004) in their book, *The 21st Century at Work*,

> The rapid pace of technological change is expected to continue to propel demand for highly skilled workers who can develop the new technologies and bring them to market and who can exploit the new technologies in the production of goods and services (p. 79).

This increased competitive level is stimulating innovation and creativity in a way never before seen, and the phenomenon will likely continue, as Friedman exclaimed to his own children: "The world is being flattened. I didn't start it and you can't stop it, except at a great cost to human development and your own future" (Friedman, 2004, p. 469).

Catalysts of Change

The New Web

Tim O'Reilly (2005), a successful publisher and technology visionary, has been a keen observer and facilitator of the Internet and Web evolution. Indeed, his mantra and business model have been to "change the world by spreading the knowledge of innovators." O'Reilly's discourse largely focuses on the impact of these new technologies on business and development models with an occasional nod to education. During a series of brainstorming sessions in 2004, O'Reilly and his associates coined the term "Web 2.0" to describe a radical shift in the design, development, and use of the Web. In his essay "What is Web 2.0" (2005), O'Reilly described the current Web as a platform that supports an "architecture of participation" not previously seen in earlier Web iterations. A central theme of the new Web is harnessing the collective intelligence of millions of users who now have the ability to not only "read" but can also "write" across a connected, distributed environment. The changes are surprising and often counterintuitive.

An example of this new paradigm is Wikipedia. A w*iki* is computer software that allows users to collaboratively create, edit and link web pages (Wikipedia: Wiki). Wikipedia is a *wiki* application which allows thousands of users to read, write, and collaboratively modify each others' work in near real time fashion. Wikipedia's greatest strengths are closely associated with its obvious weaknesses. The advantages of near constant updating, revisions, and relevance to current events and discovery can be diminished by the obvious potential for errors and inaccuracies, gross oversights, information instability and deliberate abuse. The Wikipedia community editors closely

surveil changes and promptly correct errors when notified. A study conducted by Viéga, Wattenberg, and Kushal, (2004) found that the accuracy of Wikipedia's content was comparable to the *Encyclopedia Britannica*. Although not without risks in terms of expertise, coverage, volatility of information, Wikipedia has become very popular for fast and flexible retrieval of information (Denning, Horning, Parnas & Weinstein, 2005).

Another example of this seemingly counter-intuitive approach for creating successful products and outcomes is seen in the open source movement, officially launched in 1998 but with historical roots in the Advanced Research Projects Agency Network (ARPANET) and computer programming communities (Wikipedia: Open Source Movement). Open source is described as, "the principles and methodologies to promote open access to the production and design process for various goods, products, resources and technical conclusions or advice" (Wikipedia: Open Source). In the case of software, these products are typically distributed under a license which allows a user to modify, copy and redistribute the work for free or for a fee. Further, users agree to redistribute their products under the terms of the license without imposing further restrictions. A copy of the programming source code must be included with the product. Tens of thousands of software applications have been distributed for free under this licensing framework. Wikipedia itself runs on open source software. Over 50% of the World's Web servers run on the operating system Linux and the Web server application Apache, two well-known examples of open source software (Netcraft, 2007). All of these applications can be downloaded for free.

These two examples illustrate several conceptual themes that are part of this study. First of all, they demonstrate that individual intelligence can be manifested

collaboratively and gathered across a disparate group of individuals, transferred, and distributed in such a way that leads to successful and tangible outcomes. Heterogeneous and autonomous groups giving independent voice and effort to ideas and artifacts often have a better chance at a successful outcome than homogeneous groups under more structured conditions (Surowiecki, 2005). The idea of intelligence being accessible and expandable across a near-synchronous and connected, digital environment comprised of individuals and groups, and the additional intellectual synergies this can enable, is more fully explored in Chapter 2. Under conditions where different kinds of intelligences are now "out of the bottle" and explicitly represented through symbols (Vygotksy, 1978), or implicitly embedded in artifacts (Pea, 1993), now have a chance to follow multiple learning paths-of-least-resistance within and across globally connected individuals and groups. Internet-savvy youth is one of several groups that intuit and understand these new processes very well and appear to passionately embrace the tools that support them.

Internet Savvy Youth

This new wave of transformation is not driven only by individual entrepreneurs, multinational corporations, and informal communities joined together to satisfy some need or purpose, but is also manifested in the attitudes, beliefs, and behaviors of many young people. Levin and Arafeh (2003) of the American Institutes for Research conducted a qualitative study for the Pew Internet and American Life Project. They examined the widening gap between increasing expectations of Internet-using teens and the current level of Internet use for instructional purposes in schools. Levin and Arafeh (2003) found that these Internet-savvy youth (ages 12-17) comprised about 30 to 40% of

the total teens that responded to their survey ($N = 764$). Many of these students had been online for five to six years and were technologically literate. This large and growing cohort of technologically elite students used a wide array of online applications and relied heavily on the Internet for school and in their social lives (p. 11). Others have noted the emergence of this unique group of teens. Galarneau and Zibi (2006) observed that the array of skills in which these youth are engaged fit very well with 21st Century technology needs. Other reports describe them as *non-conformists* who are the first to explore the boundary line of Internet-related constraints and possibilities both in and out of school (de Boor & Li, 2007).

Connecting to the Internet is the norm for Internet-savvy youth. Eighty-seven percent of American youth between the ages of 12 and 17 have logged onto the Internet and about 68% have used it at school (Hitlin & Rainie, 2005, p. 1). Ninety-four percent of youth ages 12-17 who have Internet access reported using the Internet for school research, and 78% stated they believed the Internet helped them with schoolwork (Lenhart, Rainie, & Lewis, 2001, p. 2).

Another study of 10- to 17-year-old youth growing up in Silicon Valley, the heart of technology innovation in the Unites States, revealed that 95% of boys and 97% of girls have gone online (Kaiser Foundation, 2003, p. 8) and 89% have done homework online (p. 4). Ninety-five percent reported having Internet access at school (p. 18). A major finding was that more children are logging on at a younger age. The number of children aged ten to 13 years old who have logged on to the Internet before the age of 10 are three times greater than the number of children 14-17 years old (p. 4).

These teenage "digital natives" (Prensky, 2001) are heavy users of the Internet. Searching for current data and information for homework assignments, participating in online group discussions, and staying in touch with family and friends via instant messaging are common behaviors often performed simultaneously. Teenagers who have ready access to computers and broadband connectivity tend to view and use technology in radically different ways than their parents, older siblings, and even other peers (Levin & Arafeh, 2003, p. 12). They are passionate about their Internet experiences:

> I'm constantly amazed at the vast resources that are available on virtually any topic that comes to mind. I rarely approach any assignment or question without first consulting online resources . . . . Practically every area of my life has been impacted by my experiences on the Web. The Internet has been a gift to my life – High School Girl. (p. 13)

However, teen expectations of how the Internet might be used in the classroom are increasingly at odds with the way it was currently deployed.

> When I go to school, it takes a long time to get online, and by that time, the project you're trying to do is already half over . . . . it's no use anyway." -- Middle School Girl. (p. 26)

> At our school, we don't use the Internet. We have it available but it's mostly for the high school students. The older kids, they have the Internet class. . . . If you want to use the internet for a project, it has to be on your own time . . . at home, or whatever." -- Middle School Boy. (p. 21)

Online Gaming

Playing online games is a hugely popular activity among these teens (Lenhart, Madden & Hitlin, 2005), and over 80% of Internet using teens reported playing games online (p. 2). A survey of some 650 MIT freshman found that 88% of them had played computer games by age 10 (Squire & Jenkins, 2003, p. 8). The intensity and passion that young people devote to games and the cognitive and social enrichment that seem to result from certain kinds of gaming experiences have garnered increased attention from the

educational research community (diSessa, 2000; Gee, 2003; Squire & Jenkins, 2003). While traditional thinking is often skeptical of using games pedagogically, others see increasing value in today's work and learning environments. In a *Wired* magazine article by John Seely Brown and Douglas Thomas (2006), "You Play World of Warcraft? You're Hired!", the authors cited the relevance of gaming skills to high powered jobs requiring creativity, resourcefulness and the ability to strategize and execute across groups. They referred to the byproduct of playing massively multiplayer online games (MMOGs) as "accidental learning" (p. 1). Salomon, Perkins, and Globerson (1991) referred to this kind of learning as "cognitive residue," which can occur not only as a result of playing games but also from interaction with intelligent technology tools (p. 4). Today, this kind of learning seems to be happening in informal online learning communities where kids vigorously participate, collaborate, and passionately focus their creative energies in the form of individual and collective creative expression and activity.

For an increasing number of people, particularly young teens, daily Internet access and use are transparently woven into their daily lives. The ways in which Internet-savvy students speak about the Internet in relation to school is closely related to their daily tasks and activities (Levin & Arafeh, 2003). In other words, the Internet's value for students is centered on daily tasks, play and entertainment, and the content they want to learn both in and out of school. These teens tend to be critical of how teachers have under-utilized technology in the classroom and suggest dozens of ways the Internet might be utilized in leaning. Examining how these students use the Internet, when and how often, where they access the Internet, and why they use it may provide important clues to ways in which schools need to change pedagogically.

Although computing and Internet connectivity is becoming more ubiquitous at home and across multiple devices used by many teens (Horrigan, 2007a), school continues to be the number one place where educators can guide students in using new technologies and the Internet (Hitlin & Rainee, 2005). Virtually all public schools are now wired for Internet access (Department of Education, 2006) and the cost of computers and laptops continue to decrease (Svensson, 2007). Software applications relevant and conducive to constructivist learning are often free or available at low cost. Selecting new technologies and redeploying existing ones to scaffold a constructivist ecology of learners involved in creative expression, social collaboration, and interactivity have become a siren call from many educational theorists and researchers (Brown, 2007; Dede, 2000; Gee, 2003; Jenkins, 2006). Many children eagerly participate in this kind of framework but evidence of this is found primarily outside of schools.

Background of the Problem

Although the Internet continues to evolve rapidly into a more complex and sophisticated technological structure, steeped in a participatory culture that thrives on innovation, creative expression, and collaboration, schools have not yet fully participated. This should not be surprising because the United States has lagged behind in Internet access and speed. Japan, for example, offers ubiquitous speeds in excess of 100 megabits per second (Mbps) and Korea provides comparable speeds as well. Most current United States customers are fortunate to get one tenth of this speed while paying more (Hoffman, 2007). The following statistics are indicative of the velocity of change at the global level. The United States was fourth in 2001 in terms of broadband subscribers per 100 inhabitants (Horrigan, 2005, p. 1). In 2006, the United States fell from 23rd to 25th place in household broadband penetration but moved to 24th place during the last quarter, 2006 (Web Optimization, 2007).

With notable exceptions (Anderson & Dexter, 2007; Kaiser, 2003), schools seem bogged down in "back to basics" skill-and-drill practices and multiple-choice testing (Gee, 2003). There is apprehension on the part of educators, government, and business leaders about whether our children will be equipped to meet 21st century challenges in learning and work spaces (Horizon Report, 2007; Visions 2020, 2002). A litany of reports has expressed these concerns for the last 25 years (See National Commission on Excellence in Education's, *A Nation at Risk*, 1983), but they have grown more urgent with the emergence of a rapidly changing, distributed, and connected world.

Other problems exist. The worrisome issue of technology "haves" versus "have nots" has predictably grown into a "digital-capabilities divide" exacerbating existing problems of gender and racial representation in technology (Galarneau & Zibi, 2006).

One problem is the use of anachronistic instructional approaches that continue to emphasize a teacher-centered, "blackboard and chalk" approach, emphasizing de-contextualized facts presented to a passive audience of students. Recently, Microsoft's chairman and co-founder, Bill Gates, made this comment to the nation's governors:

> Our high schools were designed 50 years ago to meet the needs of another age. Until we design them to meet the needs of the 21st century, we will keep limiting--even ruining--the lives of millions of Americans every year. (Galarneau & Zibi, 2006).

Chris Dede (1997), a Harvard University Education professor and well-known scholar of educational issues expressed a similar concern: "The most dangerous experiment we can conduct with our children is to keep schooling the same at a time when every other aspect of our society is dramatically changing."

Students are no longer sitting passively. For a variety of complex reasons, they simply do not show up. The National Center for Education Statistics has reported a gradual decline in drop-out rates over the past 30 years (NCES, 2005) to a little over 10% for all races in 2004. Others, however, have estimated the drop-out rate at 30%, with African-American kids approaching 50% (Educational Testing Service, 2005). In either case, an alarming number of young people are not reaching this basic educational milestone. It seems logical that intense, school-related engagement in technology activities that are motivating many students outside of school might have a positive impact on these discouraging statistics.

Another issue is socio-economic. Individuals with low incomes and educational levels (regardless of race) are generally much less likely to use the Internet (Horrigan & Smith, 2007). Forty percent of African Americans have broadband access at home, up significantly from 14% in early 2005 (2007), but they still trail all adult Americans with broadband access at home (47%) (2007, p. 1). Schools with Internet access may be the only viable option for children from these groups. However, Internet-enabled schools do not guarantee a positive learning experience or even general access. Despite the fact that 99% of schools are wired for the Internet, 32% of all teens do not use the Internet at school (Hitlin & Rainie, 2005, p. 2). High household income levels play a role. Ninety-three percent of teens in households earning more than $75,000 per year are online at home with a high-speed connection in most cases (Lenhart et al., 2005, p. 11).

Statement of Problem

Over the last 20 years, billions of dollars have been spent on technology for education, but implementation and resultant positive outcomes witnessed in other sectors (government, military, and business) have not fully taken hold in schools. Human assets in the form of under-utilized populations (female, minority students, students with disabilities), continue to be severely underrepresented in science, technology, engineering, and mathematics (STEM) careers (National Science Foundation, 2007).

Well-designed research studies demonstrating improved learning outcomes due to technology and Internet use have been few and mostly controversial. Clark, for example, attributed media research problems to a "confusion of technologies" in relation to instructional methods that often confound research conclusions (Clark, 1994). Scarr (Salomon, 1991) ascribed these difficulties of finding conclusive evidence to "a cloud of

correlated events" (p. 7) given the effects of the social, cultural, and institutional contexts where learning takes place. Norris, Sullivan, Poirot, and Soloway (2003) contended that positive instructional outcomes were not possible due to a continued lack of sufficient access. In their survey, fully two thirds of K-12 teachers state that they make minimal or no use (less than 15 minutes/week) of Internet technologies with their students (p. 4). The obvious conclusion here is that you cannot show results without access. Internet-savvy students have reported that the single greatest barrier to Internet use at school is the quality of access to the Internet. They also want better coordination between Internet use outside of school with in-class activities. They argued that "this could be a key to leveraging the power of the Internet for learning" (Levin & Arafeh, p. 5).

Technology and Internet related activities that engage students are largely taking place outside of teacher supervision and schools (p. 4). One starting point in understanding how instruction might keep pace with today's learning needs is to look more closely at the attitudes, beliefs, and behaviors of Internet-savvy children. Having grown up with technology and access to the world's online resources, they have demonstrated a constructivist culture of engagement and informal learning that John Dewey would delight in. Internet-savvy children have achieved this culture by intrepidly exploring and shaping a digital world into their own and in so doing, have acquired what most would consider to be 21st century skills. In accomplishing this, these children have unintentionally created a pedagogical roadmap that educators might be able to use in order to inform the instructional transformations that would benefit classroom practice.

Middle School Youth

This study's sample consists of academically talented and well-abled eight to fourteen year- old children. Although this population represents a fairly narrow segment of the middle school population overall, the pedagogical and learning framework for gifted students is embedded in interactive and participative environment of the Internet today. Del Siegle (2005, p. 33) noted the overlap of technology literacy goals and major goals for gifted education. These skills are updated from the North Central Regional Educational Laboratory's web site and are shown below (2007).

- Demonstrate a sound conceptual understanding of the nature of technology systems and view themselves as proficient users of these systems.
- Understand and model positive, ethical use of technology in both social and personal contexts.
- Use a variety of technology tools in effective ways to increase creative productivity
- Use communication tools to reach out to the world beyond the classroom and communicate ideas in powerful ways.
- Use technology effectively to access, evaluate, process and synthesize information from a variety of sources.
- Use technology to identify and solve complex problems in real-world contexts.

Given these common and congruent goals, it seemed logical that evidence of Internet-savviness would more readily and distinctly emerge in the gifted and academically talented group.

Middle school is also a transitional and important time for students regarding technology (Dooling, 2000). Interest and active participation in the culture of computing can gain momentum both at home and in school under the right conditions (p. 2). For

many young learners, however, who lack access or support at home, school becomes the primary venue for influence during this transitional time. In particular, interest in critical areas of math, science and technology begins to wane during this period, especially for girls and minorities (American Association of University Women, 2000; Tapia & Lanius, 2000). A central theme of Shoffner (2006) in her research of STEM intervention during early adolescence is that students' early beliefs and perceptions strongly influence their educational and career choices at critical points during their educational and career development. During this formative time, exposing all students to the benefits of using technology in a guided and instructionally purposeful way becomes critical.

Research Questions

The following research questions have been framed to better understand how educators can harness the use of the Internet for better instructional use in schools.

1. Can an instrument be developed that defines and measures Internet-savviness and its underlying factors in children ages eight to fourteen years old?
2. Is there a relationship between a measure of Internet-savviness and six measures of Computer Mediated Communication, Social Collaboration, Creative Expression, Internet Self-Efficacy, Internet Fluency, and Information Gathering?
3. Is there a relationship between Internet-savviness and age, gender, Internet access speed, and Internet use location (e.g. home, school, and library)?

Definition of Terms

The following terms identify the major construct of the study--Internet-savviness--and its underlying dimensions in this study.

Internet-Savvy children

Internet-savvy children are young adolescents who are comfortable and confident on the Internet. They use the Internet extensively for personal and school tasks and activities. Using the metaphorical descriptions of middle and high school students from Levin and Arafeh's (2003) study helps provide a definition. They described their use of the Internet for school in this way (p. 4):

- The Internet as virtual textbook and reference library
- The Internet as virtual tutor and study shortcut
- The Internet as virtual study group
- The Internet as virtual guidance counselor
- The Internet as virtual locker, backpack, and notebook

Children who were considered to be the most Internet-savvy were veteran users of the Internet, multitasking their way across many different applications to communicate with friends, conducting school research and preparing presentations for class (p. 11). Levin and Arafeh (2003) suggested that 30 to 40% of teens ages 12-17 responding to their survey of Internet use (N=754) fell into this technologically elite group. In another report, *Creating and Connecting*, these kids are described as "adventurous non-conformists who set the pace for their peers." (de Boor & Li, 2007, p. 4).

Creative Expression

The term Creative Expression describes the activities of children who use the Internet for personal expression and creative work. These activities might include authoring and publishing websites, designing and creating artwork, blogging, podcasting, and creating video artifacts. Lenhart and Madden (2005) found that 57% of online teens create content for the Internet (p. 2). A significant percent of this group (19%) reconstitute or "re-mix" various forms of existing media (audio, video, and images) into entirely new and unique creations (p. 2).

Internet Self-Efficacy

Internet Self-Efficacy is defined as individuals' beliefs about their capabilities to produce designated levels of performances or outcomes in navigating the Internet and accessing its resources for personal or school use (Bandura, 1986). Exploration and use of new Internet tools and resources that they perceive to be of interest and use in their lives would be eagerly investigated by children who have high Internet self-efficacy.

Internet Fluency

A common definition of fluency includes such descriptors as "easily changed or adapted," "knowledgeable," and "skillfulness and with expertise" (Fluency: meaning). Internet Fluency not only includes children who have extensive knowledge of the Internet but who also possess the core competencies and skills to navigate and make use of its resources. An example of a child possessing Internet fluency might be one who could not

only provide a definition of a homepage but could also change the homepage in any browser.

Social Collaboration

Children co-construct knowledge in a social context (Bedrova & Leong, 1994). Further, when these interactions take place in a larger, "real-world" framework, meaningful to the learner, the opportunity to learn is expanded (Brown, Collins, & Duguid, 1989). Socially collaborating on an online project, activity or problem allows for an exchange and sharing of ideas and artifacts which deepen learning (Bednar, Cunningham, Duffy & Perry, 1995). An example of this might be working in an online study group to research, write, and present a research paper in class.

Computer Mediated Communication

Computer Mediated Communication (CMC) involves communications using a wide variety of formats and tools to exchange conversation or data between two or more individuals. Today, synchronous forms of communications, (audio, video) and asynchronous forms (instant messaging, email, chat rooms, and discussion forums) provide a framework for one-to-one, one-to-many, and many-to-many modes of communication and are familiar tools for all users of the Internet, particularly young users (Lenhart et al., 2005). CMC is the key enabler for social collaboration in a virtualized setting.

Information Gathering

Information Gathering involves both information literacy and fluency. This construct includes the ability to use Yahoo, Google, and other specific and generic search engines to find resources of interest. It might also include the use of keywords and tags along with boolean operators in order to make successful searches. Given the sea of information found on the Internet, this skill also includes the ability to filter, discriminate, and verify accurate from inaccurate information often found on the Internet (American Association of School Librarians & Association for Educational Communications and Technology, 1998).

Organization of the Study

An introduction to the study, background, statement of the problem, and the study's purpose were presented in Chapter 1. Research questions and definitions of relevant terms were presented in Chapter 1 as well. A review of relevant literature is provided in Chapter 2. Major topics discussed include the theoretical foundations of social constructivism and distributed intelligence of the study and the education learning theory that grounds the constructs underlying Internet-savviness. The research methodology used for this study is presented in Chapter 3. Included in this chapter are the research design, population, sample, sampling techniques, instrumentation, statistical procedures, and limitations of the study. Chapter 4 presents the quantitative and qualitative results of the study. Chapter 5 delivers the interpretation of the results, findings and provides suggestions for other areas of research investigation.

CHAPTER 2

LITERATURE REVIEW

Do not train children to learning by force and harshness, but direct them to it by what amuses their minds, so that you may be better able to discover with accuracy the peculiar bent of the genius of each.-- Plato

Introduction

The first part of this chapter describes the recent changes that have taken place on the Internet in terms of how data, information, and knowledge are acquired, managed, and shared. The new affordances of a distributed, connected environment have been embraced by individuals and multinational corporations alike, across political, social and economic cultures (Friedman, 2005). A technologically elite group of teens is also using these new affordances as well and are active and enthusiastic participants in this new, connected world. Although the contexts and motivations of these groups are radically different, they have one thing in common: convergence on a single, digital framework that highly values information and knowledge as a means to pursue interests and to create and achieve goals.

In this study, the construct of Internet-savviness is presented as a way to unify and more clearly understand the underlying factors that characterize these teens' attitudes, beliefs, and behaviors. The balance of this chapter investigates the theoretical foundation

of these factors and explains how they are deeply embedded in a long-standing legacy of cognition and learning inquiry. It is suggested that these theories and constructs are beginning to converge on a distributed and connected framework and are manifesting in several ways today, including through the Internet behaviors of teens.

Children come to school with preconceived ideas about how the world works and their role within it (Bransford, 1999). These preconceived structures of thinking and perception form very early in pre-adolescence and are often influential on decision points during adolescence and later adult life (Shoffner, 2006). If children's prior experiences and prejudgments are not taken into account, they simply disengage and continue with their preconceptions outside of the classroom (p. 4).

Connecting to the Internet is the norm for Internet-savvy youth (Lenhart et al., 2005). These students arrive at school with certain attitudes, beliefs, and behaviors and frequently with considerable experience and knowledge about the Internet. Marc Prensky coined the term *digital native* to refer to today's students (2001). He describes them as native speakers of technology, fluent in the digital language of computers, video games, and the Internet in contrast to *digital immigrants* which includes most adults. This leads to a bifurcation in education, according to Prensky, with "school" "becoming an increasingly expiring and irrelevant institution. Its only function for many students is to provide them with a credential that their parents say they need. The informal, exciting half of kids' education occurs "after school." This is the place where students learn about their world and prepare themselves for their 21st century lives (Prensky, 2006).

Eighty-seven percent of youth between the ages of 12 and 17 have logged onto the Internet and logging on is happening at a younger age (Kaiser, 2005, p. 2). The

majority of these online youth are creating and sharing original content or remixing other content into entirely new artifacts (Lenhart & Madden 2005, p. 2). Major activities include sharing self-authored content including artwork, photos, stories, and videos, as well as working on web pages for others. Older girls stand out over boys in creating and sharing self-authored content (p. 10). Keeping a personal webpage and reading and writing blogs are also popular activities. Older girls lead the blogging category here as well. An encouraging sign for girls is that teen bloggers tend to be Internet-savvy and heavy users of the Internet (p. 3).

Disruptive Nature of Change

What are the catalysts of change? Certainly one factor has been the ability to create and share knowledge across a globally distributed and connected network in near real time fashion. The main ideas and concepts underpinning the World Wide Web, from its initial conception through its continuing development, have always been about shaping, managing, and sharing data, information, and knowledge. From its beginning, the Web's visionaries and co-creators (Berners-Lee, 1990; Bush, 1945; Englebart, 1962; Licklider, 1960) conceptualized a mechanism for knowledge creation and storage, managed and distributed across a network and allowing ubiquitous connectivity. Vannevar Bush, an American engineer and science administrator, was driven by the need to capture the sprawling and rapidly expanding body of scientific research and knowledge stimulated by two World Wars. In the late 1930s he created "memex," an early predecessor to the Web, as a way to collect and organize information. He envisioned a device in which "an individual stores all books, records and communications, and mechanized so that it may be consulted with exceeding speed and flexibility. It would

function as an enlarged intimate supplement to his memory" (p.4), indexed, expanded and linked together, directly accessible or remotely accessed by the touch of a key (p. 4). This system would serve both as a personal library and as a repository of ideas that could be accessed by others. The information would be shared through "associations" for easy and flexible identification, access, and retrieval. This idea led to hypertext and hyperlinking, two fundamental characteristics of the World Wide Web. In 1960, J.C.R. Licklider envisioned the development of human interaction with computers as a cooperative interaction or "symbiosis" augmenting human intellect through connectedness in the form of networks. Although Licklider had not read Bush's article--though he felt Bush's ideas had diffused enough for him to have benefited -- Douglas Engelbart had. Engelbart provided an extensive summary of Bush's ideas in his report entitled, *Augmenting Human Intellect: A Conceptual Framework* in October 1962. On December 9, 1968, he gave what many refer to as "The Mother of All Demos" in the San Francisco Convention Center where, with the help of his geographically distributed team, he previewed and demonstrated Bush's "associations," now renamed "hypertext", along with the first computer mouse, video conferencing, teleconferencing, and email (Engelhart, 1968).

During the 1980's, Tim Berners-Lee, a computer scientist at the European Organization for Nuclear Research (CERN), proposed an early Web prototype using hypertext and common storage. In 1990 he wrote a program called "WorldWideWeb" that extended these ideas to a platform that facilitated the exchange of data and information among his fellow researchers (Berners-Lee, 1998). Berners-Lee simply overlaid his hypertext-based system on top of the open, standards-based Internet

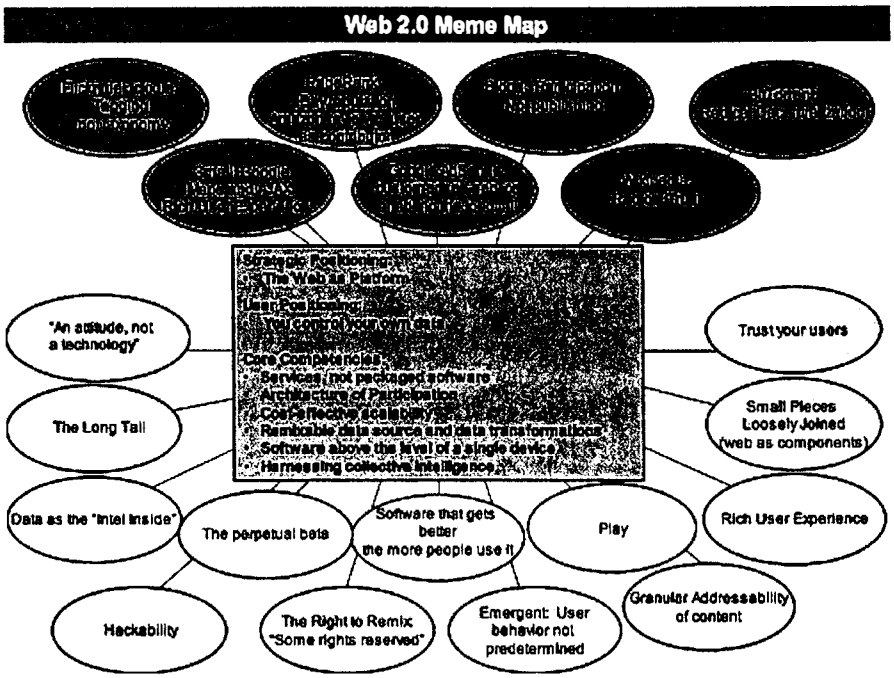
infrastructure and the first iteration of the World Wide Web was launched on August 6, 1991. Berners-Lee continues to oversee the Web's development, making it easier for people and machines to recognize, share and reuse data.

Internet and Web based technologies are rapidly changing. The most profound changes are manifested in what is popularly referred to as "Web 2.0" (O'Reilly, 2005). This platform is richly interactive, communicative, and socially collaborative. It promotes resource sharing and creative expression – activities that are constructivist in nature and embraced by teens. Internet-related activities that deeply engage youth appear to be cognitively and socially enriching (Brown & Thomas, 2006).

Constructivism 2.0

O'Reilly's observations and thinking are strikingly relevant to teaching and learning. His meme map, shown in Figure 1.0, visually details the chief characteristics and behaviors of all users on the Internet today. Upon closer inspection, the features he ascribes to current users and the online environment in which they are currently working in is mindful of a constructivist teaching and learning model. These characteristics and features are shown in the lower half of O'Reilly's Web 2.0 Meme Map in Figure 1.

Figure 1. O'Reilly's Web 2.0 Meme Map (used with permission).



Some examples are "Perpetual Beta" describing a classroom learning environment that is flexible, adaptable and continuously being updated with new features and characteristics; the importance of "Play" in learning; "The Long Tail" (Anderson, 2004) which suggests the "silent" majority of students, whose talents and abilities often go undiscovered to themselves and teachers in a large class; An "attitude," not a technology .

In many cases, the connection between the Web and learning can be seen via a simple substitution of the word "learner" for "user." For example, O'Reilly described "users" as communicators, collaborators and co-developers who actively contribute and share creative work (O'Reilly, 2005). Individual user behaviors emerge and manifest in an intelligent gestalt that exceeds the actions and intellectual capabilities of any one individual. This organic form of activity and learning is deeply rooted in a number of

cognition and learning theories that have been around for quite some time but are now "getting a leverage," as Dewey (1897) would say, because they coincide with the activities of millions of daily users of the Internet. The disparate motivations, attitudes and behaviors of global business entities, technology visionaries and Internet-savvy kids all underscore the epistemological notion of social constructivism and its corollaries in a pursuit of knowledge acquisition, management, and distribution.

Constructivism is a theory that views learning as an active and dynamic process with the learner at center stage, internalizing new information and synthesizing it with existing knowledge (Bruner, 1963; Piaget, 1955). Learners are challenged to shape and experiment with their ideas, perceptions, and personal experiences while assimilating them into a social, cultural, and cognitive context that is meaningful to them. Vygotsky (1978) suggested that social interaction and engagement are fundamental to learning and are absolutely necessary to developing one's full range of cognitive capabilities. He emphasized that the interactions of the learner with others is paramount in constructing new knowledge and always involves creating internalized representations of new information through this kind of exchange. (Bedrova & Leong, 1994). When multiple perspectives are shared through thoughtful interaction with others, the learner through reflection can modify these representations or discard them. Social and intellectual growth become a positive sum experience (Bednar, Cunningham, Duffy & Perry, 1995).

One of Vygotsky's (1978) many contributions to cognitive science is the concept of Zones of Proximal Development (ZPD). A ZPD can be defined as a set of activities in which individuals can optimize and enhance their own learning experiences and

knowledge through the interested and active guidance of more advanced peers, teachers, and groups. Vygotsky explained the ZPD as:

> the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers. (Vygotsky, 1978, p. 86)

A broad conclusion reached by Dooling (2002) in interviews with fourth through seventh graders was that their attitudes, expectations, and skills regarding technology were shaped by parents (particularly fathers) siblings, family friends, and co-workers.

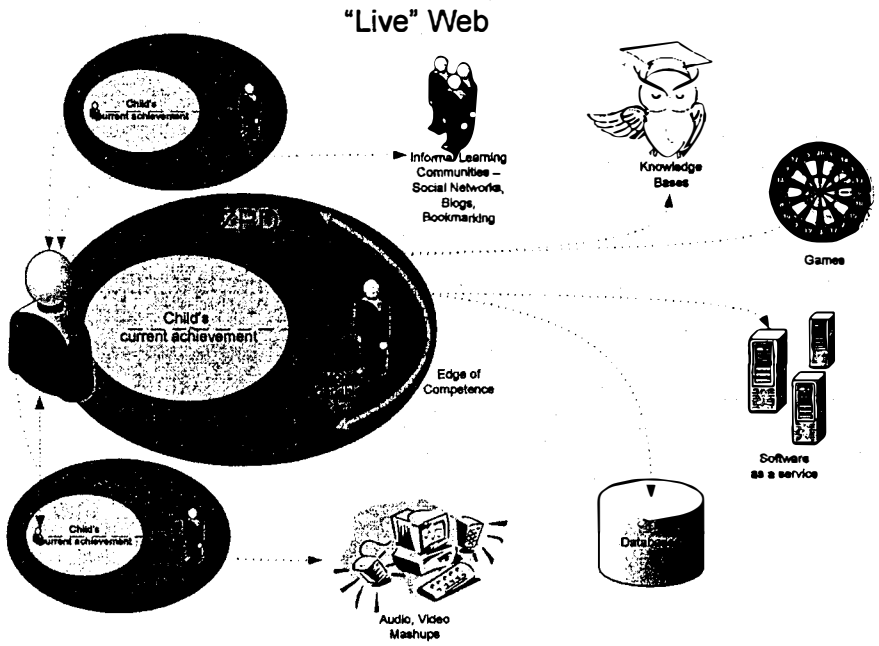
Artifacts as Peers

In a virtualized, connected environment, many different individuals, services, groups, and artifacts now serve as proxies to guide learners into new areas of knowledge that are of interest to them. The depth and breadth of the world's knowledge, represented across a wide variety of learning modalities and mediums, is increasingly available to the learner. Co-constructed knowledge between learner and "more capable peers" in Vygotsky's model is greatly enhanced and amplified in today's connected world.

By extending Vygotsky's ZDP model into today's distributed, globally connected environment, the potential benefit for cognitive development and exponential knowledge growth becomes more evident. Expanding the idea of cognition and intelligence that manifests beyond oneself and across the environment makes Vygotsky's model more dynamic and current. Roy Pea (1985) anticipated this possibility in an essay in which he considered the child-computer system as a developmental unit. "More capable peers" might now include such artifacts as "intelligent agents" and other programmatically

based objects designed to assist and guide users on increasing their understanding and knowledge of any subject. One can hear or view an audio or video podcast of today's visionaries discussing almost any topic of interest or "sit in" on any one of hundreds of courses or symposia being offered online by elite universities worldwide (see UC Berkeley's presence on Google Video; or Stanford on iTunes U). Piaget proposed that a child's construction of knowledge arose primarily through interaction with physical objects (Bedrova, & Leong, 1994), whereas Vygotsky's view was that knowledge was co-constructed with at least one other individual. These theories become more convergent and unified when placed in today's context of virtualized object manipulation, informal learning communities and socially collaborative work and play environments. Figure 2 shows how the classic ZPD model can transparently and seamlessly iterate into other ZPDs and include social communities, databases and digital artifacts.

Figure 2. The Zone of Proximal Development in a distributed, connected environment.



The ease and ability to tap into the collective intelligence embedded in informal learning communities (study groups, forums, discussion boards, blogs, and social networks to name a few) that exist as assistive resources available to any Internet user seem to support explicit and implicit learning taking place outside of the traditional classroom and at an early age. In this scenario, the ZPD becomes more iterative and granular based on the kind and quality of the learning activities and artifacts included. Learners have more control over what and how they learn by choosing their own ZPDs. They may even customize and tweak the ZPD's learning objects as necessary to facilitate their own learning needs. For example, a Google Alert is a service that allows users to receive the latest updates regarding any query or topic. Users can set up searches on news, blogs, groups, or the entire Web and can be notified by email as updates occur or on a daily or weekly basis. Google Alerts object properties can be easily modified and fine tuned to provide the results desired.

As learners evolve, they may eventually choose to become a member of the "more capable peers" group in order to "give back" as a direct participant in guiding others or, indirectly, through the artifacts they create that serve as learning objects within the scope of the ZDP in which they have become proficient. Today's virtualized ZPD models are characterized by collaboration and sharing where the learner maintains a "locus of control." In a study of game characteristics that influence intrinsic motivation, Malone and Leper attributed control as a key element in establishing a learner's intrinsic motivation along with cognitive curiosity, challenge, goals, uncertain outcomes, and choice (Malone & Leper, 1987). These attributes are not only present in games but in

many other activities, greatly amplified by a distributed, connected environment. Intrinsic motivation plays a vital role in any learning activity but is fundamental in what Salomon, Perkins and Globerson (1991) referred to as "mindful engagement" between user and "intelligent" computer tools and technology (p. 4). Mindful engagement enables users and intelligent technology to bind together in a kind of partnership that facilitates learning.

Distributed Intelligence

The concept of distributed cognition or intelligence proposes that human knowledge and cognition are not confined to the individual but are externally manifested in the form of representative artifacts and across people, environments, and situations (Hutchins, 1995; Pea, 1993; Salomon, 1993). Proponents of this theory argue that artifacts, from language to computer algorithms, become representations or tools that are part of the process of intelligence (Hutchins, 1995; Pea, 1993: Salomon, 1993; Smagorinksy, 1995). Intelligence, "which comes to life during human activities," may be crafted and is part of the social and material dimensions of distribution (Pea, 1993, p. 50). Pea's argument, influenced by Vygotsky's Zone of Proximal Development, described activities such as guided participation in parent-child interactions, apprenticeships, or people's collaborative efforts to achieve shared aims as key elements in constructing knowledge (p. 50). Pea maintained that objects and tools can carry intelligence within them from previous reasoning in the form of physical and functional design. They have embedded a kind of economy that provides a cognitive short-cut and helps minimize error. The intelligence conveyed by the affordances of the product or service becomes available to individuals through direct use or through observations of use by others (p.

53). Today's examples might include online mortgage calculators, GPS locators and tax preparation software. Attempts to imitate its design, form, or function through tinkering, playful discovery, or guided participation by experts, potentially becomes an even more powerful learning experience (p. 65).

Within the realm of the "live" Web (Levy & Stone, 2006) where examples of these kinds of experiences abound, one instance that demonstrates this phenomenon is the open source software movement mentioned earlier. Open source software includes source code and the freedom to de-construct and remix code into new applications. The opportunity to "tinker" with code and other attributes of technology provides a hands-on experience that is key to increasing skills and understanding (American Association of University Women, 2000). Dooling (2002) found that middle school children liked to learn about computers by trying things out. They used a kind of trial-and-error method for individual exploration. A sixth grade girl in his study noted, "I personally prefer to explore the computer on my own. I learn by doing, not by listening" (p. 21). Papert (Pea, 1993) suggested that teachers who provide direct instruction rob learners of the opportunity to discover knowledge for themselves. Well- programmed, open source software artifacts may not only carry "cognitive economy" (Pea, 1993, p. 53) but may also provide the opportunity to de-couple and examine the implicit intelligence built into the design and function of the application. Exposing the coding logic, syntax and structure becomes a guide and blueprint for learning new skills and contributing further to the affordances and innovation of the product.

Although counterintuitive to traditional strategies of building software artifacts, the results of these kinds of community-based efforts and their outcomes in the form of

products have been impressive. Over 50% of the world's web servers are powered by open source software (Netcraft, 2007). Sourceforge.net, a repository for open source applications, had 161,328 registered projects available for downloading and use in early November, 2007 (Sourceforge, 2007). Although this open source development example seems far removed from the traditional instructional model, the collective intelligence embodied in a dedicated group of users who freely share and collaborate on their ideas, strategies and artifacts represents a powerful resource that only a distributed, connected environment can provide. As mentioned previously, a significant percentage of Internet-savvy teens "re-mix" existing content (their own and others) into new and unique creative products shared with others across the Internet (Lenhart & Madden, 2005). The end result of these re-creations or "mashups" requires even more expertise, skill, and imagination to develop. A wide range of abilities is needed to de-construct, modify, and manipulate a multitude of different media objects (audio, video, text) and programming interfaces into unique creations.

Pea (1993) argued that the transformative effects of new technologies serve less as "cognitive amplifiers" and more as "reorganizers of mental functioning" (p. 57). Human cognition aspires for efficiency, and a learner's activities naturally drive them toward the tools and conditions that best achieve this state (Pea, 1993). It seems evident that Internet-savvy teens have intuitively grasped this concept when one examines the list of how they use the Internet for school related activities (Levin & Arafeh, 2003).

Many children have grown up with a computer and are facile with its uses. Now, they are becoming adept with a connected environment that greatly expands their opportunities to engage and explore new knowledge in a context meaningful to them.

Many clever and famous quotations have addressed the "disconnect" between what one learns in and outside of school (See *Quotes on Education* reference). When school learning and content goals do coincide with what teens are engaged in outside of school, it seems logical that cognitive processing heuristics begin to form and content retention is reinforced. This situation may partially explain the "accidental" learning that Brown (2006) attributed to online, multi-player game experiences and the "cognitive residue" that Salomon assigned to more general technology-based activities (Salomon, 1993).

Knowledge Networking

Data, information, and knowledge are being constructed, managed, and distributed across an increasingly sophisticated array of networked resources that both facilitate and amplify intellectual curiosity, creativity, and innovation. Young children with the means and support to do so naturally look at the Internet as a tool not only to accomplish specific ends but to better understand themselves in a complex world. Unfortunately, these rich resources and activities are beginning to take hold in about every other place except schools.

> The power of distribution – of storing knowledge in other people, texts, tools and technologies – is really the way in which all of these things are networked together. The really important knowledge is in the network – that is, in other people, their texts, their tools, and technologies, and crucially, the ways in which they are interconnected – not in any one "node" (person, text, tool or technology), but in the network as a whole. Does the network store lots of powerful knowledge? Does it ensure that this knowledge moves quickly and well to the parts of the system that need it now? Does it adapt to changed conditions by learning new things quickly and well? These are the most crucial knowledge questions we can ask in the modern world. They are hardly reflected at all in how we organize schooling and assessment in schooling (Gee, 2003, p. 185).

The National Science Foundation calls this "knowledge networking." In reaction to the recent and disruptive shifts in technology and the rapid movement to a connected

environment, they have launched a series of multi-disciplinary studies exploring how new, connected technologies can foster Knowledge and Distributed Intelligence (KDI) not only for the benefit of science but for all learning in general (National Science Foundation, 2007).

Educators often strive to have their students emulate the behavior and thinking patterns of historians, scientists, professional writers, or poets who are considered experts in their profession. Bereiter and Scardamalia (1993) maintained that one of the key differences between experts and novices is their respective levels of knowledge (p. 43). Their definition of knowledge includes much more than skills or formal knowledge. It also includes "tacit" or "invisible" knowledge (Bereiter and Scardamalia, 1993, p. 46) that can be derived from working at one's "edge of competence" (p. 37). The edge of competence fits nicely with Vygotsky's ZPD model, where one works iteratively out and beyond his/her zone of capabilities and knowledge acquisition. Vygotsky stated that expertise already exists in the culture and the learner's first contact with it comes from engaging in activities with people who already have that expertise (Bereiter and Scardamalia, 1993, p. 114). Today, the "culture" in which Internet-savvy youth exist is multi-modal, distributed, connected, and global. The opportunity to work at one's edge of competence in an area of interest becomes ever-expanding.

Constructs for this Study

The constructs considered in this study have emerged from a wide range of sources, including articles, studies, and reports, from both private and educational sectors. This approach was taken as a way to triangulate and show convergence on important new learning characteristics that address 21st century learning needs. All of these constructs,

however, are firmly grounded in the educational learning theories of social constructivism and distributed intelligence.

Creative Expression

The ability to innovate and think divergently is a valuable skill and the act of creating is considered to be one of the highest forms of cognitive functioning (Manthey, 2006; Plucker, Beghetto & Dow, 2004). Today, the ability to think, act, and creatively respond within a digital framework holds obvious attraction for companies seeking out individuals who can innovate and thereby help them stay globally competitive (Sternberg & Lubart, 1999). Divergent thinking and creative expression are typically pronounced as premier skills needed for 21st century success (21st Century Work Force Commission, 2000; Horizon Report, 2007). There is, however, little opportunity in schools to create (Manthey, 2006). Sir Ken Robinson, an internationally-renowned expert in the field of creativity and innovation in business and education, contrasted what he described as the "extraordinary capacities" children have for innovation and creativity to the dearth of opportunities in schools to nourish these attributes (Robinson, 2006). He maintained that supporting children's creativity in schools is as important as literacy and should be given the same status.

The ability to create involves problem solving (Baer, 1995; Clements, 1995; Plucker, 2004). In a study investigating the effectiveness of creativity training for ill-structured and complex problem solving, Baer (1995) found that eighth grade students in the treatment group who received special training in creative problem-solving techniques significantly outperformed a control group who did not receive training. Subjects in both groups were pre-tested on four subtests consisting of (a) data-finding, (b) problem-

finding, (c) idea-finding, and (d) solution-finding just prior to the training and post-tested six months later. The experimental group outperformed the control group on all four measures indicating that the skills learned were retained.

Traditionally, creative insight and its manifestations have been viewed as singular, solitary events (Csikszentmihalyi & Sawyer, 1996). When the "life span" of creative insight is more closely examined, however, "the moment of insight appears as but a short flash in a complex, time-consuming, fundamentally social process (p. 4). Csikszentmihalyi and Sawyer (1996) conducted a study involving interviews with creative individuals of note and included samples of mathematicians, economists, poets, authors, sculptors, and a world renowned ceramicist in order to illuminate the contribution of social interaction to the process of creative insight. One scientist used the following analogy to describe the role of collaboration:

> Science is a very gregarious business; it's essentially the difference between having this door open and having it shut. If I'm doing science, I have the door open. That's kind of symbolic, but its true. You want to be all the time talking with people . . . it's only by interaction with other people in the building that you get anything interesting done; it's essentially a communal enterprise. (p. 20).

Gerhard Fischer (2005) maintained that creativity and other forms of cognitive processing may be better understood within a socio-technical and distributed framework. Creative actions are less planned and more situated in response to the "talk-back" that diverse, socio-technical environments can provide (Schön, 1983, in Fischer, 2005). The challenge becomes one of supporting, managing, and integrating such interactions where "conceptual collisions" and breakdowns amongst a heterogeneous and diverse group of individuals may be exploited for innovation and growth (p. 2).

In a connected environment, the ability to "brainstorm" with others using a wide variety of distributed tools (wikis, blogs, audio and video conferencing) may be used to increase the efficiency and velocity of generating ideas in a fast paced world while avoiding the loss of momentum found in groups who interact face to face (DeRosa, Smith, & Hantula, 2007).

Many young teens seem to embrace these online activities even more enthusiastically than the most tech-savvy adults. The following comparison of content-creating teens to their adult counterparts was created from data collected in two Pew Internet studies conducted approximately 18 months apart (see Table 1). The adults – considered to be "elite" Internet users consisted of eight percent of the adult population and were 28 years old. Males made up 70% of the group and 89% had broadband in their homes (Horrigan, 2007). The table below compares the teens to the adults on five online, user generated content (UGC) activities common to both studies.

Table 1: Content Creation Activities

User Generated Activities (UGC)	Adults (Elite Users) (Horrigan, 2007)	Teen Content Creators (Lenhart & Madden, 2005)	Teens Who Blog (Lenhart & Madden, 2005)
Share your creations (artwork, photos, stories or videos).	55%	33%	69%
Create or work on your own webpages.	45%	22%	58%
Create webpages or blogs for others, including friends, groups you belong to, or for work.	40%	32%	61%
Take material you find online – like songs, text, or images – and remix it into your own artistic creation.	30%	19%	35%
Create or work on your own online journal or weblog.	34%	19%	n/a*

* not compared in the study

The Adult group led the content-creating teens in every category. Blogging teens, however, tended to be far more active in content creating and sharing activities than non-blogging teens. Interestingly, when comparing blogging teens to the most elite adult technology users in UGC activities, they led in every category.

Internet Self-Efficacy

Self-Efficacy

Bandura (1986) defined the general construct of self-efficacy as a self-judgment of one's capabilities to achieve a successful outcome in terms of a behavior or task. It operates in concert with other socio-cognitive factors in establishing a path of well-being and personal attainment across a broad and diverse range of social settings and behaviors (Pajares, 1997). Self-efficacy influences the choices we make, how much effort we put forth, how long we persist when confronted with obstacles or during the threat of failure, and how we feel about the result (p. 2). Self-efficacy is mediated by past experiences (successes or failures) or, vicariously, through observing others who succeed or fail at a particular task or assignment. Verbal persuasion and cues from peers, relatives, and teachers may also influence an individual's feelings of self efficacy. It is context or domain specific in terms of how people view their own competence in carrying out certain tasks or performing certain actions. For example, one might have feelings of high self-efficacy while performing mathematical tasks but experience low self-efficacy in reciting a poem. Another example in the context of this study might be a 10 year-old girl who has high self-efficacy while playing basketball but low self-efficacy while playing computer games.

Computer Self-Efficacy

The increasing ubiquity of technology and the importance society places on our individual and collective ability to wield it properly have created difficult challenges for most individuals. For some time, the concept of computer self-efficacy has been seen as important in the study of attitudes, beliefs, and behaviors toward computing and has been shown to be a major determinant in understanding the frequency and success in computer use. Compeau and Higgins (1995) found that individuals with high self-efficacy used computers more and experienced less computer related anxiety. Eachus and Cassidy (2002) identified self-efficacy as a pertinent factor in the context of computer use, with higher levels of computer user self-efficacy (CSE) associated with greater self-rated computer competency and experience. They found high correlations between CSE and self-reported measures of previous computer experience, number of computer applications used and computer training. They also found differences in CSE between males and females, with males reporting higher levels of computer self-efficacy across all measures including different levels of training. Other researchers (Torkzadeh & Koufterous, 1994), however, showed these differences to be mitigated by training. Busch (1995) investigated gender differences regarding computer attitudes and perceived self-efficacy and found significant differences on complex tasks involving word processing and spreadsheet software but no differences in simple computer tasks involving these applications. Their results indicated also that previous computer experience was the most important factor in self-efficacy differences.

Web Self-Efficacy

Eachus and Cassidy (2006) have extended their study of computer self- efficacy to self-efficacy beliefs in using World Wide Web. They developed the Web Users Self Efficacy (WUSE) instrument for adults and tested self efficacy beliefs across four domains, including Information Retrieval, Information Provision, Communications, and Internet Technology. This developmental study showed low reliability scores for the individual components but an acceptable reliability coefficient (.801) for the overall scale (p. 6). Although results were somewhat mixed, they showed that participants with experience in using the Internet had a stronger sense of self-efficacy and that males scored significantly higher than females in all four domains.

Computer Mediated Communication

Computer Mediated Communication (CMC) refers to any form of interpersonal communication that uses some form of computer technology to transmit, store, annotate, or present information that has been created by one or more participants (ITiCSE'97 Working Group). CMC provides a context and medium that can facilitate individual and collaborative learning (Li, 2002). As more schools and educational institutions have gained access to the Internet, its use as a teaching and learning tool has increased dramatically (Li, 2002; Murphy et al.). CMC can either be synchronous as represented by real-time chat, audio, and video modes, or asynchronous in which exchanges are not made in real-time (Labo, Reinking, & McKenna, 1998). An example of this would be email. These modes of CMC and their stable use as a teaching and learning tool are often mediated by availability and ease of access to hardware, software, bandwidth, network

infrastructure and technical support. Getting these resources properly aligned is a challenge for any organization and schools vary widely in their ability to consistently deliver Internet services to the instructional classroom or computer lab (Lenhart, 2001).

Asynchronous online communications have been used extensively in learning environments and text-based forms of communication are still prevalent and instructionally useful. Harasim, Hiltz, Teles, and Turoff (1995) and Mason and Kaye (1990) suggest that a deeper understanding of issues can be achieved when learners are engaged in writing rather than talking. Reasons for this might include the fact that learners have more time to reflect on their responses, to research topics in a medium where all have a better opportunity to participate.

Labo, et al. (1998) cited the use of CMC as a way to increase digital literacy and information exchange by connecting children in other cultures, geographic regions, or countries. Students exchange a wide variety of digital artifacts including photos, video clips, interviews, and survey data as they engage in "informing, narrating, inquiring, arguing, persuading, and entertaining to make their ideas understandable and even memorable." (p. 13). These various discourse formats and acts of sharing form the underlying basis of increased understanding and deeper meaning.

Hoadley and Enyedy (1999) took the view that CMC is one of the main components by which individuals construct and negotiate meaning within the larger framework of computer-based media. CMC is inherently communicative, interactive, and collaborative since all media presumes some audience even if the audience is oneself.

Communication, information sharing and collaborative interfaces have been undergoing a renaissance of change in the last several years and have become more

convergent, cheaper, and easier to use. Previously, these sub-systems rarely overlapped and were context specific to their respective domains of function and process (p. 2). Now, these systems are cohering on a Vygotskian platform that can provide a seamless means of communication, collaboration and activities for participants as they move from novice to experts at their own pace (Wertsch, 1985). This kind of "learning trajectory" (p. 4) is best supported through tools that support both monologic and dialogic forms of communication in which learners first "make visible" their early and less precise formations of meaning and understanding under the guidance and direction of more learned peers. As understanding and articulation of a concept or idea becomes more clearly understood, it can then be synthesized and presented as a way to demonstrate competence and to establish consensus amongst a community of learners. Hoadley and Enyedy (1999) explained:

> Learning is not a single, monolithic event, but is comprised of a series of separate, interrelated activities. This implies that a learning trajectory is likely to include a number of different contexts, some of which may be best supported by dialogic, communication interfaces and some of which may best be supported by monologic, informational interfaces. The point is to endeavor to offer the right tool to the student at the right time along the student's leaning trajectory. Better still, if we develop tools that fill out the "middle spaces" of the continuum, that offer more structured dialogues, more open monlogues, and ways to quickly move back and forth between different modes of collaboration, students will be able to use the tools in a manner supportive of their learning, wherever they happen to be in their learning trajectory at the moment (p. 6).

It is important to note that dialogic, formative, work-in-process outcomes and the synthesized monologic results that ideally follow, can manifest not only in deeper understanding of ideas and concepts but in artifacts, products, and processes that reflect cognitive progress. The multi-modal, "read-write" nature of a digital, connected

environment and the tools that support it enables these cognitive processes and exchanges to occur in a much more seamless and transparent fashion than ever before.

Internet-savvy teens seem to intuitively understand the affordances of today's CMC tools as a means for personal expression and information exchange. They view email as something used to talk to "old people," institutions, or as a means to send complex instructions to large groups (Lenhart et al., 2005). While 49% of adults only occasionally use "modern gadgetry" and many others bristling over electronic connectivity, these teens have moved ahead to more interactive, synchronous, multimodal forms of communication (Horrigan, 2007, p. 1). When talking with family and friends, instant messaging (IM) is preferred and used by 75% of online teens and 48% use it every day (p. 25). Forty-five percent own their own cell phone. Teens take full advantage of the wide-ranging capabilities of today's instant messaging systems either on the desktop or on mobile devices. Forty-five percent have used IM to send photos or documents, links to articles and websites and audio and video files (Lenhart & Madden, 2005, p. 33).

Social Collaboration

Learners construct knowledge by interacting with object structures (Bedrova & Leong 1994; Papert, 1993) and with each other (Bedrova & Leong 1994; Soller, 2001). In today's collaborative learning and work environments, creativity and innovation expressed as ideas quickly manifest in the forms of new knowledge and original artifacts. Using the tools of CMC, individuals can easily exchange information and knowledge bits that together form an intelligent gestalt in which the group can outperform any one individual. James Surowiecki (2005) found that a group of average but diverse individuals, in an environment characterized by autonomy and unencumbered by external

expectations, had more predictive power and often made better decisions than a panel of experts.

In a student-centered, collaborative learning environment, individuals become active and autonomous learners working with their peers to shape, reconfigure, modify, expand, and refine their thoughts, ideas or artifacts (ITiCSE'97, 1997). Working within a geographically dispersed and culturally diverse group expands the possibility of enriched learning that cannot happen on an individual basis (p. 53).

The general law of cultural development (Vygotsky, 1978) proposes that higher mental functioning is initiated by interaction with learned others then followed by an internalized process of reflection, conscious realization, and mediation through tools (Smagorinsky, 1995). From this perspective, cognition is no longer studied in individuals working in isolation; instead, the emphasis is on individuals working with a variety of tools and people who help them carry out their goal-oriented activities in a socio-cultural setting. Such a perspective might highlight how Internet-savvy youth intuitively embrace the plethora of Internet based applications and use them to "mediate" tasks, interests and activities meaningful to them.

Until very recently, these kinds of mediational tools were unavailable to educators in a way that supported their transparent instructional use both in and outside of the classroom. As Lim (2002) stated, Dewey's (1963) idea of children learning much better in a context of their own living experience and Vygotsky's (1978) ideas of social interaction and conversation have been difficult to implement in a way that affects the classroom instructional setting. Salomon (1992) described learning collaborations as intellectual partnerships with both peers and advanced informational technology. He

distinguishes effects *with* a tool and/or collaborating peers and effects *of* these. He explains, "Effects *with* are the changes that take place while one is engaged in intellectual partnership with peers or with a computer tool." (p. 62). Effects *with* require the learner to do the thinking and problem solving, while effects *of* focus on achieving a result without really understanding it. Making the learner, rather than the computer tool, do the thinking and problem solving is the goal of *effects with* which Salomon claims, is much more mind cultivating. This result combined with social interactions "pull" cognitive changes which lay the groundwork for possible subsequent improvement in the student's solo capabilities (p. 62). When students worked with computer technology in a way that constitutes "volitional mindfulness," (p. 63) or "mindful engagement" (Salomon, Perkins & Globerson (1991, p. 4) where students are in control, positive outcomes consistently resulted. Salomon (1992) claimed that under this condition, the introduction of computers realized an important potential turning point in moving from simple assimilation into a process of active construction of knowledge. He posed the question, "Can we arouse the necessary mindful engagement to make this happen?" (p. 63). He stated,

> Indeed, if the computer is allowed to serve in the capacities it serves best – affording representation, manipulation, exploration, and creation of symbols and symbol systems, its employment affects most everything else in the classroom. Its use shifts learning from recitation to exploration and construction, from being individually-based to being team-based, and from being separated by disciplinary lines to being interdisciplinary. The computer can thus be seen as a "subversive instrument", a Trojan horse, if you wish, the proper use of which requires self-guided activities, team work and ongoing interdependence. (p. 63)

Salomon's (1992) idea of volitional mindfulness operating within a framework of rich computer tools and social interaction is demonstrated by teens using the Internet

outside of school. One of the major activities of Internet-savvy teens is their online participation and use of social software. Social software today is participatory and includes many different kinds of server based applications and services including blogs, wikis, podcasting, bookmarking and videoblogging. All of these manifestations of social software involve communities of users coming together to share, exchange, interact, and communicate ideas, thoughts, opinions, artifacts, and beliefs in varying degrees. The desire to share ideas and existing knowledge and to store and distribute it in an efficient and seamless way have a long history in the evolution of the Internet with roots back to Bush (1945), Licklider (1960, and Engelbart (1962). Previous incarnations of social software include bulletin boards, listservs, and Usenet groups which attracted a wide group of users who wanted to come together and share common interests and ideas.

Lenhart and Madden (2007) found that young, tech-savvy teens have embraced social networking. Fifty-five percent of all online American youths ages 12-17 use an online social networking site. Older teens, particularly girls, are more likely to participate in these communities (Lenhart & Madden, 2007, p. 1). They defined social networking web sites as places where users can create and connect their personal profiles to other profiles to make an explicit personal network. Facebook and MySpace are popular social networking sites among teens and young adults. Key findings in Lenhart and Madden's study of teen (ages 12 – 17) use of social networking included the following elements:

- 55% of online teens have created a personal profile online. The same number of teens has used social networking sites like MySpace and Facebook.
- 66% of teens who have created a profile limit access to it.

- 48% of teens visit social networking web sites daily or more often.
- Older girls ages 15-17 are more likely to have used social networking sites and online profiles. Seventy percent of older girls have used an online social network compared with 54% of older boys. (p. 1).

Eighty-five percent of teens who use social networking have a profile on MySpace. ComScore, a company that measures growth in the digital world, reported that, MySpace.com attracted more than 114 million global visitors age 15 and older in June 2007, representing a 72% increase compared to a year ago. Facebook.com experienced even stronger growth during that same time frame, jumping 270% to 52.2 million visits (ComScore, 2007).

Principal uses of social network sites revolve around staying in touch with a friend, including friends seen often and those rarely seen in person. Teens also use the sites for scheduling events with friends (Lenhart & Madden, 2007, p.5). Although there are multiple ways to communicate within social networking environments, the most popular is to post comments to a friend's page or "wall," send a private message, or post to a friend's blog.

Another increasingly popular technology that brings together users interested in information exchange, consensus, and resolution in the form of common understanding or a more tangible end product are wikis (Newsweek, 2007). The democratized nature of wikis, low cost, and scalability to handle thousands of users, is appealing to organizations who value the opinions, feedback and participation of their members. The magnitude and mainstream use of wikis is evidenced by their adoption by workplaces, corporations and even governments as these entities move from hierarchical, top-down structures to

more decentralized and collaborative settings which transcend organizational and geographic boundaries (Newsweek, 2007). IBM, for example, has used wikis since 2005 and introduced these applications into their own products and services shortly thereafter. "Collaborative software has become a very important part of how businesses will invent and innovate," says Ken Bisconti, IBM's vice president of messaging and collaboration software. Other government institutions and world organizations, including the United Nations, use wikis to capture diverse opinions, exchange information and build consensus. Sixteen United States intelligence agencies within the United States government have begun using a common wiki called Intellipedia to merge research and intelligence gathering. WikiCongress, established by congressional staffers, allows the public to vote on bills, create petitions, and propose new policy. Summaries of these results are then forwarded to legislators.

Information Gathering

Seeking and gathering information in a way that informs thinking is a complex process. It is a process that includes multiple stages of questioning, asking and refining, information gathering, and finally, evaluation, synthesis and use of the information (Wallace, Kupperman, Krajcik and Soloway, 2000). Very little recent research has been done on effectively searching the Internet for accurate, high-quality information. Search engines have become an increasingly popular and an important part of the online experience of American internet users (Rainie & Shermak, 2005). On an average day, nearly 60 million people use search engines (p. 1). Teenagers use the Internet to gather information for personal use and for school assignments (Lenhart et al., 2005).

Information specialists frequently complain that the quality of online information varies widely and that credible information is too hard to find (Kiernan, 2006). Users often decide whether to believe a particular Web site's information on the basis of how professional the site appears or how closely the site's information matches their own views (p. 1).

Wallace, Kupperman, Krajcik and Soloway (2000), in a study of sixth grade math students, concluded that the process of information seeking requires intentional modeling and scaffolding over time. Wallace et al. investigated how sixth grade math students engaged in the information-seeking process. They reported that students spent the majority of their time (69%) negotiating the search engine and 31% of their time examining content, with only cursory examination and infrequent use of the content pages' links (p.18). The search process became the main focus. The most common method students used to evaluate sources was whether or not the content contained the key words they expected to find in answering their question. Navigation strategies were very basic. One pair of students used the 'BACK' button 25 consecutive times to find a previous page. Search strategies were characterized by simple, repetitive key words and search behaviors were erratic and random. Students focused on finding a perfect web page, and finding a concrete source to answer their question. Getting a small number of hits was viewed as a positive result and further removed students from understanding the content. Students were easily frustrated at not finding specific answers. Information seeking seemed to be an unfamiliar activity. The most common method students used to evaluate sources was to look for the words they expected somewhere in the resulting content.

In their publication *Information Power: Building Partnerships for Learning*, the American Association of School Librarians and the Association for Educational Communications and Technology (1998) defined *information literacy* "a keystone of lifelong learning" (p. 1). The ongoing process of digitizing and indexing the world's information and knowledge requires both the ability to critically evaluate new information and knowledge quickly and to use it accurately and creatively in ill-structured situations (Dede, 2000).

Today, the grist of problem-solving and creating solid knowledge foundations require rapid retrieval of accurate information. Much of the data, information and baseline knowledge, however, is vague, incomplete, and often erroneous (p. 1). Filtering data and information for decision-making and building new knowledge becomes a critical skill. Searching the Web and the myriad online databases available to the public and specific groups of users is often a laborious and frustrating task for casual and experienced users. In order to better understand Web based knowledge structures and the strategies employed for successful searching, Hölscher and Strube (2000) interviewed 12 established Internet experts about their search methods and then asked them to perform a series of search tasks on the World Wide Web. They found that experts relied on a wealth of Internet-related knowledge and domain knowledge to complete successful searches (p.3). In a second part of the experiment four distinct groups were selected with the combined presence or absence of the two independent variables, Web experience and domain knowledge. The subjects were asked to complete a different series of search based tasks. Overall, results showed that novice users had severe problems with formulating a reasonable query and were unaware of a number of core problems of Web

searching including the limited scope of individual search engines and the necessity to state a search query at an adequate level of specificity (p. 5). The differences found between the Web novices and the Web experts pointed to specific deficiencies in the novices' knowledge and could be directly addressed in Internet skills training. Subjects with little domain knowledge made significantly longer queries (average query length: 2.96 vs. 1.97 words). Hölscher and Strube speculated that domain experts know more appropriate terms and hence need fewer of them to get results (p. 9).

Almost 9 in 10 teens are Internet users (Lenhart et al., 2005). Finding information they are interested in includes looking up information about health, diet or physical fitness, religious and spiritual information, and research information for school projects and activities (p. 7). More than half of teens (55%) seek political news online. Seventy-six percent of teens get news or information about current events (p. 35) and 57% get information on events they might attend (p. 36). Older teenage girls (aged 15-17) significantly led boys in the number of searches, time spent searching and topics searched.

Internet Fluency and Proficiency

The underlying capability of participating in the increasingly rich avenues of learning and knowledge creation is directly related to proficiency in using today's new technology tools. Increasingly these tools are Internet based, synchronous and reside in a socially collaborative and distributed framework. We have moved from the local, standalone desktop to this new online framework in a very short period of time. The Department of Education reported that over 99% of schools are wired for Internet use (2006).

Statistics indicate that 90% of K-6 teachers use computers with students and 52% have at least two computers in their classrooms (Labo et al., 1998). Labo et al. outlined five key concepts for digital literacy which gird and support Internet fluency and the other five dimensions previously outlined (p. 277):

- *The ability to be a lifelong learner.* New knowledge, products and services are being created at an increasingly prodigious rate. New innovation, reinvention and rapid obsolescence require constant learning and updating of skills.
- *Digital literacy acquisition and development often occur in the pursuit of other goals.* They need to access and use digital resources and applications that are increasingly threaded into everything we do.
- *Digital literacy occurs in social contexts.* Over 12 million teens engage in social networking where they communicate, exchange ideas and artifacts (Lenhart et al. 2006).
- *Digital literacy requires strategic competencies.* Today, digital data, information, and knowledge take multiple forms and may be delivered through different kinds of media and devices, from mobile phones to large screen projection systems. This information and knowledge must then be accurately synthesized and evaluated in order for it to make sense and augment an individual's existing knowledge domain. The two studies under Information Gathering addressed the difficult issues confronting educators in on this topic.
- *Digital literacy requires critical knowledge assembly and production.* Today's students must be critical consumers and producers of information. Gathering disparate information and integrating it into a clear and concise whole requires

presentation and design skills. Students have not learned to question the reliability or integrity of the information they can so easily access (p. 278).

The move from a "one-way," passive mode of learning that has characterized traditional media and teaching has been eclipsed by a richly interactive, "read/write" online environment that is profoundly different and exciting. The new technologies of today involve coding, a wide array of audio, imaging and video, hypermedia and hypertext linking, and other forms that support the notion of just-in-time learning, a key 21st century skill.

In focusing on Internet fluency and proficiency, educators not only shore up critical skills that scaffold other, higher-order skills that augment learning, they have another opportunity to correct bias and inequities that exist in the technology sector. Werner, Campe, and Denner (2005) found that middle-school girls, who participated in an after-school game design program, made substantial strides toward Information Technology fluency (Werner et al., 2005).

ISTE Standards

According to their Web site, The International Society for Technology in Education (ISTE) is a trusted source for professional development, knowledge generation, advocacy, and leadership for innovation mandated to provide leadership and service to improve teaching, learning, and school leadership. Its focus is on advancing the effective use of technology in PK–12 and teacher education. ISTE represents more than 85,000 professionals worldwide and more than 90% of U.S. states have adopted, adapted, or referenced the National Education Technology Standards (NETS) in state

department of education documents (International Society for Technology in Education, 2007).

ISTE recently reviewed and refreshed its 9-year-old NETS. To accomplish this overhaul, ISTE tapped the collective intelligence of interested stakeholders (education, business, government) to devise the most accurate and meaningful standards possible. These newly revised standards reflect a national perspective and desire for what children should learn regarding technology.

NETS is structured according to students, teachers, and administrators. The constructs chosen for this study closely align with the new ISTE NETS performance indicators for technology-literate students. Tables 2 (ISTE, 2007a) and 3 (ISTE, 2007b) show these relationships between the performances for third through fifth and sixth through eighth grade students and the constructs chosen for this study.

Table 2: Comparison of ISTE Standards (grades 3-5)

Comparison between Proposed ISTE Standards (grades 3-5) and "Internet-Savvy" Constructs	
All students should have opportunities to demonstrate the following performances. Prior to completion of Grade 5, students will:	*Internet Savvy-Constructs*
1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively.	• Internet fluency
2. Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide	• Internet Self Efficacy
3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use.	• Internet Self Efficacy
4. Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum	• Internet Fluency
5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom	• Computer Mediated Communication • Creative Expression • Internet Fluency
6. Use telecommunications efficiently to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests	• Information Gathering • Computer Mediated Communication • Internet Fluency
7. Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	• Computer Mediated Communication • Internet Fluency • Information Gathering • Social Collaboration
8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem solving, self-directed learning, and extended learning activities.	• Internet Fluency
9. Determine which technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems	• Internet Fluency
10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources	• Information Gathering • Internet Fluency

Table 3. Comparison of ISTE Standards (grades 6-8)

Comparison between Proposed ISTE Standards (grades 6-8) and "Internet-Savvy" Constructs	
All students should have opportunities to demonstrate the following performances. Prior to completion of Grade 8, students will:	*Internet Savvy-Constructs*
1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use	• Internet fluency
2. Demonstrate knowledge of current changes in information technologies and the effect those changes have on the workplace and society.	• Internet Self Efficacy
3. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.	• Internet Self Efficacy • Social Collaboration
4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research.	• Internet Fluency • Internet Self Efficacy
5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum.	• Computer Mediated • Communication • Creative Expression • Internet Fluency • Information Gathering
6. Design, develop, publish, and present products (e.g., Web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom.	• Creative Expression • Internet Fluency
7. Collaborate with peers, experts, and others using telecommunications and collaborative tools to investigate curriculum-related problems, issues, and information, and to develop solutions or products for audiences inside and outside the classroom.	• Computer Mediated • Communication • Internet Fluency • Information Gathering
8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems	• Internet Fluency
9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity and of practical applications to learning and problem solving.	• Internet Fluency
10. Research and evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources concerning real-world problems.	• Information Gathering

Summary – Chapter 2

One of the primary objectives of this study is to investigate Internet-savviness as a multidimensional construct in academically talented and well-abled, middle school children. As outlined in this chapter, the research literature on cognition and learning suggests that creative expression, Internet self-efficacy, Internet fluency, social collaboration, computer mediated communication and information gathering all play an important role in how individuals learn. These constructs are deeply rooted in well-established, social learning and cognition theories that have been extensively formulated over the past century. The most powerful of these theories situate optimal learning and knowledge construction in an authentic, socio-cultural environment where individuals are supported and encouraged to explore, create, and share ideas in a meaningful way. Although the Internet is typically lumped together with such broad categories as "information technology" or "Instructional technology," it is a profoundly different medium that provides a greatly expanded context within which learning can take place.

Computer technology has consistently disappointed in its impact on authentic and measurable learning outcomes (Clark, 1994). Many of the learning domains cited above lack representation in actual classroom practice. These domains, important to 21st century learning needs and in line with the new ISTE standards, are embodied in the attitudes, beliefs and behaviors of technologically elite teens but demonstrated largely outside of school. Closely examining the unifying construct of Internet-savviness and its dimensions in the framework of a research study will provide important clues about how k-12 education can better prepare all youth for the challenges of 21st century learning.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Overview

The study's design, population, sample, and instrumentation are described in this chapter. The intent of this study is to explore six major dimensions that characterize how children view and use the Internet in their daily lives. The overarching construct that unifies these dimensions is identified as Internet-savviness. The dimensions are (a) Creative Expression, (b) Internet Self-Efficacy, (c) Internet Fluency, (d) Computer Mediated Communication, (e) Social Collaboration, and (f) Information Gathering.

These underlying dimensions are thought to embody the attitudes, beliefs, and behaviors of an emerging group of technologically elite students who use the Internet for personal and school related activities. A review of literature in Chapter 2 suggests that the roots of these constructs and their current manifestations are grounded in the educational theories of social constructivism and distributed intelligence.

They also align with education and business stakeholder opinions and beliefs in regard to how children must prepare for meeting the demands of academic and career success in a digitally connected environment. Recently, a nationwide poll of registered voters was conducted (Partnership, 2007). Sponsored by *Partnership for 21st Century Skills*, results indicated that Americans are deeply concerned that the United States is not preparing young people with the skills they need to compete in the global economy. Over 80% of the respondents reported that the skills children need to learn for the 21st century workforce are significantly different from what they needed 20 years ago.

Description of General Approach

Survey methodology within a mixed-method research framework will be used to address the following research questions.

1. Can an instrument be developed that defines and measures Internet-savviness and its underlying factors in children ages 8-14?
2. Is there a relationship between a measure of Internet-savviness and six measures of Computer Mediated Communication, Social Collaboration, Creative Expression, Internet Self-Efficacy, Internet Fluency, and Information Gathering?
3. Is there a relationship between Internet-savviness and age, gender, Internet access speed, and Internet use location (e.g. home, school, and library)?

Dillman's (2000) principles of effective survey design and implementation were followed. High survey response rates are critical to survey research analysis (Dillman, 2000, Krathwohl, 1998). Many factors contribute to this desired outcome. Multiple contacts, appearance, design and content of letters and envelopes, personalization, sponsorship and incentives among other factors all have an impact on response rates (p. 149). In the case of K-12 research, the consent form return rate is critical. Without a consent form, a child cannot participate in the study. One may have conducted extensive planning and developed an effective questionnaire, but if care is not given to this critical first step, the study may suffer from small samples with weak power or, worse yet, may end abruptly.

The sequential schedule and common structure of the SEP sessions offered a unique opportunity to step outside of the study's main objectives and themes to explore the effectiveness of different survey implementations on consent form return and response rates. At the risk of diffusing the study's primary research questions, it was decided to manipulate the original survey implementation strategy to test for statistical significance between the consent form return rates.

Previous research on how to improve mail response indicates that multiple contacts are more effective than any other technique for increasing response by mail (Dillman, 1991; Dillman 2000, Fox, Crack & Kim, 1988). Close behind are the use of token incentives and to a lesser degree, personalization and inclusion of a stamped, addressed return envelope to maximize survey response (Dillman, 1991; Dillman 2000, p. 149).

In this study, multiple, personalized contacts were used for all three sessions. As part of the registration application, email addresses of both parents were collected along with names, mailing addresses and phone numbers. This information was collected by SEP staff and entered into a database. Approximately, two weeks before each session, an email (Appendix F), addressed to the mother or guardian of each child pre-registered for the session was sent out, alerting them to the research study and asking them for permission to allow their child to participate. This email also stated that a letter explaining the study in more detail and a parental consent form would arrive shortly in the mail. Approximately 10 days before each SEP registration, the mailing (Appendix G, H), was sent out under the imprimatur of the University. The mailing included a personalized envelope, parent letter under the University's letterhead and a copy of the

consent form signed and stamped by the Institutional Review Board (IRB), the research sanctioning body of the University. Both the email and parent letter included a link to the survey that participants would be completing. Parents were invited to review the survey and contact the researcher if they had any reservations about the questions or any other part of the research study. Parents were also promised the opportunity to review the study's results once it was complete if they were interested. Parents were asked to sign the consent form, allowing their child to participate in the research study. Parents were asked to bring the consent form with them to their child's the SEP registration. The researcher was on hand during registration to collect consent forms and to answer any questions. Blank consent forms were made available to parents who forgot their forms or who decided on the spot to allow their child's participation in the study. Approximately five days before registration, a reminder email (Appendix I), was sent to parents to bring the consent form with them to the registration. Two weeks following each session, a final email (Appendix J) was sent to parents who returned a consent form but whose child did not take the survey during the SEP session. As a final attempt to collect survey data, parents were asked to allow their children to take the survey online at home. This basic schedule of multiple contacts was applied to Session I procedures and served as a baseline for Sessions II and III.

Session II mail contact deviated from the above procedure by including a personalized, stamped, return envelope with the land based mailing. Parents were asked to return their consent forms by mail but were also advised that they could drop off the consent form during registration.

Session III's land based mailing did not include a return envelope but did include a color, one-page flyer (Appendix K), announcing the raffle of an iPod shuffle to be chosen from all returned, consent forms at the end of session III. Parents were asked to bring the consent form to registration. The survey instrument was built using the School's SurveySelect development tool and administered online. Microsoft's Excel and SPSS v. 15 were used to code and analyze the numeric data. Descriptive statistics (frequency counts, means and standard deviations) were used to present the demographic data and was further referenced throughout the chapter. Missing data analysis as well as issues of outliers, data normality and homogeneity were addressed and are reported in chapter 4. Item analysis of inter-correlations across each construct's items was conducted. Weak items were identified and dismissed from the analysis. Reliability analysis applied Cronbach's alpha coefficient as the index to test for internal consistency of each measure. Validity issues are also addressed and results reported in Chapter 4. Exploratory factor analysis with Varimax rotation was used to identify and refine the primary components embedded in the measures' data results. A comparison and discussion is made between these results and the hypothesized constructs of the study. A combination of *ANOVA* and *MANOVA* analytical techniques were used to test for significant differences between the variables of interest: age, gender, Internet access speed, frequency of use and activities, Internet use location (e.g. home, school, library) and Internet-savviness scores and domain scores. Single and multiple regression analyses were employed using IS scores as the outcome variable and age, gender, access speed, location and activities as predictors. Variance, contribution, and effect sizes are presented.

Data from the last two questions of the survey followed qualitative analytic procedures outlined in Marshall and Rossman (2006).

Pilot Study

The purpose of the pilot study was to test the Internet-savvy scale, subscales and survey questions, identify weaknesses in the design and methodology, and take corrective action in preparation for the larger study.

The initial study used a convenience sample consisting of 26, fourth through eighth grade students and was conducted at a private school in Virginia. This school's mission is focused on intellectual and personal growth for gifted and talented youth. Class sizes were small with an average of 16 students for grades K-8. Many teachers at the school have Masters degrees and several have Ph.D degrees, including the computer resource teacher. Parental involvement is strong and the school is vigorously supported by them.

The survey, consisting of 36 Likert type scale items and eight multiple choice items on the sample's demographics was administered during the week of April 16-23, 2007. Sixty-six students were given parental consent forms to be read, signed, and returned. Twenty-seven students completed the survey during school hours and under teacher supervision. One respondent had difficulties in completing the survey resulting in unanswered questions. This case was thrown out. The 26 students who did complete the survey represent a 39.4% response rate. The average time to complete the survey was 9 minutes and 23 seconds. Fourth and fifth grade respondents took slightly longer than older respondents. SPSS v. 14 was used to analyze the results.

A cautionary limitation of the pilot study was the type of sample and small number of participants. Because some members of the population had no chance of being sampled, the extent to which this sample actually represented the entire population of middle school students cannot be known. Twenty-six participants constitutes a relatively small sample size. Other things being equal, sampling error and statistical power are problematic in making firm conclusions and making generalizations about the results (Cohen, 1988). Another limitation was the homogeneity of this group which consisted of gifted and talented students, a relatively small subgroup of the middle-school student population. Gifted and talented students make up 6.4% of total enrollment in public school education (Digest of Education Statistics, 2006).

Internal Consistency Results—Pilot Study

Internal consistency of the measures was assessed using Cronbach's alpha. Results showed acceptable levels of reliability for all scales and sub-scales. Sub-domain and total scale internal reliability estimates are summarized in Table 4.

Table 4: Internal Consistency of Dimensions – Pilot Study

Internal Consistency	
Measures	**Alpha Coefficients**
Creative Expression	.761
Internet Self Efficacy	.844
Internet Fluency	.863
CMC	.915
Social Collaboration	.915
Information Gathering	.764
Internet Savvy Scale	**.946**

All results were statistically significant at $p < .001$

Item Analysis—Pilot Study

Inter-item correlations were examined at the item and sub-scale levels. Most items showed expected correlation strengths within their respective domains. The items included in the domains of Creative Expression and Information Gathering were more carefully examined because of their lower reliability coefficients. Several anomalous items were identified, investigated, and modified.

Conclusions—Pilot Study

Conclusions taken from this data must be formed very carefully due to the small sample size. Internal consistency results, however, were encouraging and additional analysis uncovered several weak items that were modified. The descriptive data also

revealed some hints at patterns of attitudes, beliefs and behaviors regarding Internet activities in and out of school and this helped guide the larger study.

Research Design

A non-experimental, mixed methods, research study was conducted. The survey population was 677, 8–14 year old academically talented and well-abled youth who attended one of three sessions of a summer enrichment program (SEP) conducted during the summer of 2007.

Sampling Design

Since a non-probability sample consisting of volunteers was used in this study generalizability beyond speculation will not be possible. Return rates of consent forms and survey response rate were determined by the number of parents who returned consent forms and the child participants who assented to taking the survey.

Sample Population and Size

Approximately 677 rising fifth through eighth grade adolescents attended a Summer Enrichment Program (SEP) at a large public university in the mid-Atlantic area of the United States. Three sessions scheduled for summer 2007 were sampled. Session I ran from June 17 through June 28; session II, from July 1through July 12; and session III, July 15 through July 26. The mission of this program is to create a unique education experience for gifted learners. Selected teachers and staff work closely with the students to create an intellectually safe and enriching environment for all participants. General goals include exploration and close examination of ill-structured and complex problems normally not encountered in regular school. Developing skills of creative problem-

solving and divergent thinking are emphasized within a wide variety of open-ended, problem centered experiences. Students are assisted in developing solid research skills. They are constantly challenged to work at high levels of thought and study and are encouraged to share their ideas through open-ended discussions. Students undergo an extensive application process that includes completion of essays and submission of standardized test scores and recommendations. Applications are blind-reviewed by two independent evaluators. Scholarships are awarded. Two hundred-twenty-five middle school youth each attended SEP sessions I and II; 229 students attended session III.

The survey was voluntary. Parental and child assent were attained before the survey was conducted. Ultimately, response rates for the study were determined by the number of parents returning a signed consent form and by the number of students who assented to taking the survey.

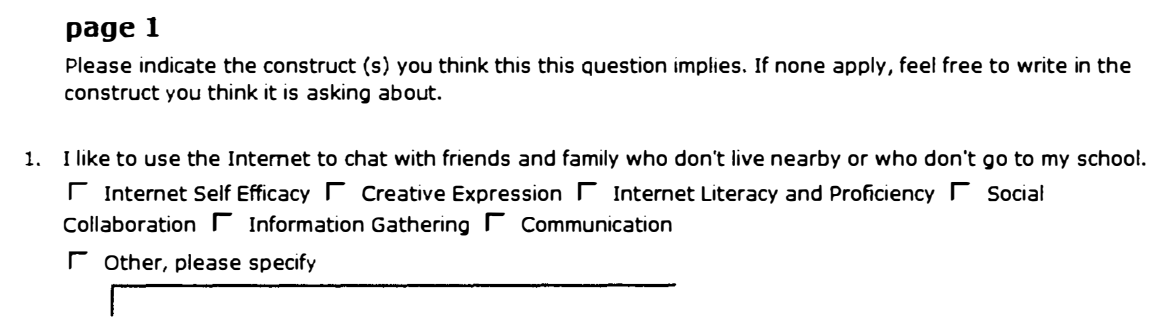
Instrumentation

Various scales exist that measure technology literacies, skills, and levels of computer self-efficacy, or different components of each (Cassidy & Eachus, 2002, 2006; Bunz, 2004), but none deal with Internet–savviness as a multidimensional construct or examine the Internet as the primary technology framework with middle school children.

A survey scale was developed and tested to measure the overall construct of Internet-savviness. Six sub-scales measured the following constructs thought to make up Internet-savviness. They are Creative Expression, Internet Self Efficacy, Internet Fluency, Computer Mediated Communication, Social Collaboration and Information Gathering.

In order to establish construct validity early in the scales' development, the survey was given to a panel of experts consisting of 12 doctoral students in education. Six of the students took a modified version of the survey that asked for extensive formative feedback. Each screen of the survey contained four items and a text box to capture feedback from the experts. These results were analyzed and weak items were modified or replaced. The survey was then reconfigured to ask the graduate students to identify each dimension that related to the question. The revised survey was entitled, "Identify the Constructs." An example of this type of question is shown below. The evaluators could choose more than one construct that applied and could also suggest their own construct or provide additional comment.

Figure 3: Sample "Identify the Constructs" question.



Responses were tabulated in a spreadsheet matrix and compared to the dimension intended for each item question. Based on this additional analysis, items were further modified and refined. Although the respondents were quite different in age from the study population, these analyses identified issues of formatting, structure, and clarity which affect item non-response and measurement error (Dillman, p. 81). The exercises also greatly strengthened the face, content, convergent, and discriminant validities that

make up the overall construct validity or "quality" of the measure (Krathwohl, 1998; Trochim, 2007).

Part I of the survey consisted of the Internet-savviness scale and its sub-scales. Each measure in the scale consisted of five to seven Likert-type items for a total of 38 items overall scale (Appendix A, Part I). Item responses consisted of *strongly disagree*, *disagree*, *agree* and *strongly agree*. Affirmation bias was controlled by wording half of the items in a negative manner so that a strongly disagree\disagree response was needed to add positively to the composite score. An overall high score indicates high Internet-savviness. A minimum score on the Internet-savvy scale was 38 with a maximum score of 152. The respondents were asked to rate themselves as an *Advanced*, Intermediate, or *Beginning* Internet users to establish a separate and independent benchmark for validation purposes and to gain better statistical insight into the construct of Internet-savviness. Membership within these three groups was compared with other variables of interest including domain scores, age, gender, Internet access, frequency of use, and Internet use location (e.g. home, school, and library) to explore the relationships between these variables.

Part II included 10 questions regarding demographic information and questions related to Internet access speed, location of access, time spent on Internet activities, and other questions relating to Internet use in and out of school. (Appendix B, Part II).

Part III consisted of 12 multiple choice questions (Appendix D, Part III) that attempted to assess the skill level and Internet knowledge level of the adolescents. This was not part of the original pilot study but during the research proposal discussions, it was suggested as a way to more closely examine the construct validity issues of the

Internet-savviness scale. These items were culled from various state- or district-sponsored tests to assess technology and Internet-use, skill levels.

In order to give the students a voice and to triangulate further on the research findings, two open-ended questions were developed for Part IV (Appendix E, Part IV). These questions were designed to elicit information about the respondent's favorite Internet activities at school and gather suggestions on how schools might be able to more effectively use the Internet in their classrooms.

The survey instrument was developed with the University's SurveySelect tool and was conducted online. Data was stored on a Curry database server and protected by the School's security program. The total time to take the Survey was expected to be 20 minutes.

Part I – Scale

Table 5 shows the dimension, operationalization, and an item example in the Internet-savvy scale.

Table 5: Dimension, Operationalization, Item—Internet Savvy Scale.

Dimension	***Operationalization***	***Item Example***
Creative Self-Expression (6 items)	Measurements of Creative Self Expression include the motivation and willingness to express personal thoughts and ideas in blogs or other online discussion boards. Also, artwork, images, audio and video objects self-created, manipulated or re-mixed are included as well.	I enjoy using different medias (audio, video, image, animation) and combining them into my own creation.
Internet Self Efficacy (5 items)	Measurements of Internet Self Efficacy address navigating and the Internet with confidence and feelings of competence.	I consider myself to be a skilled and resourceful Internet user.
Computer Enabled Communication (6 items)	Computer Enabled Communication includes the willingness and motivation to use the Internet and its tools (email, Instant messaging, Skype) as a preferred way to communicate with family, friends and others on the Internet.	I don't like using the Internet to chat with my closest friends (negatively worded).
Internet Fluency (7 items)	Internet Fluency includes questions about knowledge of the Internet and the respondent's skills while navigating and working online.	If my browser's (Internet Explorer, Firefox, Safari) homepage was changed, I wouldn't know how to reset it.
Social Collaboration (7 items)	Social Collaboration addresses the willingness, motivation and desire to collaborate with friends and schoolmates online to achieve some task or participate in group activities.	I would never consider joining an online study group. (negatively worded item)
Information Gathering (7 items)	Information Gathering addresses ability to use the Internet's informational resources and tools in a discriminating way. Searches might be for personal inquiries and school research.	I would rather get information from the Internet than from a book.

Part II – Demographic\Profile Information

Part II of the survey consisted of 10 questions. This section gathered demographic information including age, gender, and speed of Internet access at home.

Several questions asked about the time the respondents spend on various Internet activities (chatting, gathering information, etc.) and from what location (home, school, etc.). Another question asked respondents about how their teachers used the Internet by content areas of English, math, science and social studies. Several questions dealt with time spent on the Internet outside of school and time spent playing games. This section asked the participant to rate him\herself as a *Beginner, Intermediate* or *Advanced* Internet user (IS user).

Part III – Internet Skills Assessment

Part III included 12 questions about attitudes and behaviors. Some of these questions were culled from various state and local departments of education and school districts that are attempting to establish their own measures of technology literacy skills and ethical behaviors and attitudes. This part of the survey was not tested during the pilot phase.

Part IV – What do the kids think?

Part IV included two questions. The first question asked about the respondent's favorite Internet activities at school. The second question asked respondents to comment and make suggestions for better use of the Internet resources as a teaching and learning tool. The Pew study (Levin & Arafeh 2003) found that Internet-savvy kids were very dissatisfied with how the Internet was used in their schools. They had many useful and constructive suggestions for pedagogical use of the Internet. The adolescents in this study also provided valuable insights and suggestions on the Internet and how to better use this resource in schools.

Data Collection

Data records from the Director of the Summer Enrichment Program (SEP) were used to print up mailing labels for SEP participants. Email addresses of parents were used as the initial email contact. Approximately two weeks before each SEP session, an email was sent to the parents of each child, introducing the study. This email also invited parents to examine the online survey that their children would be taking (Appendix F). Approximately 10 days before registration, a letter to the parents (Appendix G) and consent forms (Appendix H) were sent out. The letter gave details of the study and asked parents to carefully read the consent form, sign it and bring it with them to registration. A reminder email was sent about five days before registration (Appendix I). Again, it invited parents to pre-review the survey and also contained a link to the consent form so that parents could download it. The researcher was on hand to collect consent forms, greet parents, and answer questions. Blank consent forms were also provided to parents who either forgot the form or had not bothered to fill it out but were not willing to do so.

The survey was voluntary and anonymous. The first screen of the survey served as the child assent verification. The survey began when each respondent clicked on the "I Agree" button (Appendix A, p. 160).

Based on SEP scheduling requirements and the plethora of program activities, survey sessions were in groups of 12 to 20 children and were scheduled on Tuesdays, Wednesdays, and Thursdays during the two week period. Participants whose parents dropped off a signed consent form on Sunday were recorded and distributed on an Excel spreadsheet to the SEP directors Sunday evening or Monday morning so that kids could be scheduled for the survey as soon as possible. Participants were checked off as they

took the survey and the list was redistributed. This schedule was largely maintained, but weather and scheduling conflicts caused several sessions to be cancelled.

The researcher met the participants at the beginning of evening activities and walked them along with their two counselors to a computer lab where the survey was conducted. The lab environment was comfortable, safe and free of disturbance. All children who were scheduled opted in and took the survey. The average time taken for all surveys was 17 minutes, 50 seconds.

About seven days after each session ended, a final email was sent to parents who had sent in a consent form but whose child did not take the survey (Appendix J). This was due to a lack of time in the SEP schedule.

Data Recording and Management

Data were collected from the SurveySelect database and downloaded after each survey session into a secure Excel spreadsheet file. Data was manually coded and imported into SPSS v. 14. All statistical analyses will be retained for future reference and used in subsequent studies.

Limitations

The following limitations should be considered.

- The survey was completed by children identified as gifted and academically talented from a non-experimental, convenience group. Consequently, the degree of Internet-savviness may emerge differently in this group compared to other gifted children and other groups in the middle-school population. A recent study considered Internet-savvy youth as defined in this study, as *non-conformists*,

rebellious in school and more often than not, "C" students (de Boor & Li, 2007). Any discussion regarding generalizability of Internet-savviness to other groups and populations should proceed thoughtfully and carefully.

- Self-reports are required in survey methodology and many variables can affect results. Some of these variables include recall strategies, instructions, mood, time of day and response formats (Stone et al., 2000, p. 26)

Procedures for Data Analysis

Descriptive statistics, primarily means, standard deviations and numbers of participants, were collected for the demographic data and all other variables of interest in the study. Missing values analysis was conducted for all scale items. Data were examined for outliers, normality, and homogeneity and reported in chapter 4. Visual inspection of the entire inter-item correlation was made for anomalous results, and inter-correlations within each construct were examined for weak correlation. Reliability analysis used Cronbach's alpha coefficient as the index to test for internal consistency of each measure and the overall Internet-savvy scale. Construct validity issues were also addressed and results reported in Chapter 4.

An Exploratory Factor Analysis with Varimax rotation was used to identify and refine the primary components embedded in the measures' data results. A comparison and discussion is made between the factor analysis results and the hypothesized constructs of the study. Eigenvalues, a Scree plot, percent of variance, and factor loadings are presented in chapter 4.

ANOVA and *MANOVA* analytical techniques were used to test for significant differences between the variables of interest: age, gender, Internet access speed,

frequency of use and activities, Internet use location (e.g., home, school, library) and Internet-savviness overall scores and domain scores. Regression analyses, including step-wise regression, were employed using various predictor variables and the criterion variable of Internet-savvy total scores. Effect sizes using Cohen's (1988) benchmarks were calculated and reported where appropriate.

Overall themes and narratives emerging from the last two question responses of the survey followed qualitative analytic procedures outlined in Marshall and Rossman (2006). Data was initially scanned for emerging themes of favorite school activities on the Internet and suggestions for using the Internet in the process of learning. Two matrices were formed. The first divided responses by gender and the second categorized responses by age. Responses by gender were coded according to the six, Internet-savvy dimensions and other popular themes that arose from the initial analysis. These matrices and frequency counts are presented in Chapter 4 and interpreted in Chapter 5. Insightful comments from the respondents are also used in Chapter 5 for triangulation and integration with the study's conclusions.

Chapter 3 - Summary

The study's design, population, sample, and instrumentation were described in this chapter. The main intent of this study was to explore the construct of Internet-savviness. A scale was developed to measure this overall dimension and its underlying constructs. Statistical analyses procedures were presented in the chapter to assess the psychometric properties of the instrument. Descriptive statistics, item and correlation

analysis, reliability coefficients, factor analysis and construct validity results are presented in Chapter 4.

Descriptive statistics, *ANOVA*, *MANOVA* and Regression procedures were used to investigate the relationships between Internet-savviness scores and its dimensions, age, gender, Internet speed, location, and activity types which are reported in Chapter 4 as well.

In order to gain further insight into the attitudes, behaviors and activities of the study's participants, the survey captured and coded two sets of responses involving favorite Internet activities in school and suggestions for using the Internet at school. This analysis and comments from the participants are presented in Chapter 4 and threaded into the interpretation and conclusion in the final chapter.

CHAPTER 4

PRESENTATION OF RESULTS

Data analysis strategies and results of the investigation are presented in this chapter. The following sections present results that address the three research questions:

1. Can a scale be developed that defines and measures Internet-savviness in children ages 8-14?
2. Is there a relationship between Internet-savviness and six measures of creative expression, Internet self-efficacy, Internet fluency, social collaboration, computer mediated communication and information gathering?
3. Is there a relationship between Internet-savviness and age, gender, Internet access speed, Internet activities, and Internet use location (e.g. home, school, and library)?

There are three main sections in this chapter. The first section provides a description of the sample and sampling procedures and presents the psychometric results in validating the Internet-savvy measures. The measures consist of 1) computer mediated communication, 2) creative expression, 3) information gathering, 4) Internet fluency, 5) Internet-self efficacy, and 6) social collaboration. Data results presented in this section address the first research question. The second section addresses research questions two and three by presenting results on the relationships between Internet-savviness and its dimensions, Internet access speed, Internet use and location by age and gender. The

third section presents a summary matrix of the major themes that emerged from student responses to the following two questions:

1. What are your favorite Internet activities at school?
2. What suggestions do you have to help your school make better use of the Internet for learning?

The Sample

Two hundred-forty-three middle school participants from a total of 677 adolescents completed the survey. The surveys were conducted during a Summer Enrichment Program (SEP) at a large, mid-Atlantic University during the summer of 2007. The program consisted of three, two-week SEP sessions scheduled during June and July. Three-hundred-twenty parents completed consent forms for a consent form return rate of 47.3%. From this available pool of respondents, 243 adolescents completed the survey during the three main sessions and post sessions (See Table 6). Not all available survey respondents were able to be scheduled due to timing constraints of the SEP program. Two survey-taking opportunities during the second SEP session were lost due to inclement weather. The survey sessions could not be rescheduled. One hundred thirty-two individuals (presumably parents or guardians) previewed the online survey.

The surveys were conducted in groups of 12 to 24 students. The researcher met with each group and together with SEP group counselors, led the participants to a computer lab situated in another building across campus to complete the survey. A combination of desktop and laptop computers were configured and set up with the first screen of the survey to minimize confusion and start-up time. Following a brief introduction and explanation of the research study, the participants read the assent screen

and began the survey. No participants opted out of the survey. Participants who completed the survey early were allowed to access a dedicated Web page and play online games previously selected by the researcher. The sessions were conducted in the early evening and lasted for 35 minutes. The average time for all respondents to complete the survey during the SEP sessions was 17 minutes and 50 seconds. Twenty adolescents took the survey after returning home from their session. Table 6 shows a summary of the results.

Table 6: Consent Form & Survey Response Rates

	Parents	***Consent form Received***		***Surveys Taken***		***Taken Post***	***Taken Final***	***Final Percent***
	N	*N*	%	*N*	%	*N*	*N*	%
Session I	224	86	38.4%	73	32.6%	1	74	33.5%
Session II	224	106	47.3%	57	25.4%	7	64	28.6%
Session III	229	128	55.9%	93	40.6%	12	105	45.9%
Totals	677	320	47.3%	223	34%	20	243	35.9%

A one-tailed, z test for proportions using an $\alpha = .05$ was used to assess for statistical significance in the return rate differences between each session. The return rate for Session I was 86 consent forms from a possible 224 parents for a 38.4% return. For SEP II the number of returned consent forms increased to 106 out of 224 possible for a return rate percent of 47.3%. The increase in results was statistically significant, $z = 1.909$, $p = .0281$ over the SEP I return rate. The SEP III session response was the best overall with 128 consent forms returned from 229 parents for a return rate of 55.9%. This result was statistically significant over SEP II results at $z = 1.826$, $p = .0339$ and at $z = 3.91$, $p < .001$.

Demographics - Age and Gender

A breakdown of respondents by age and gender is shown in Table 7. Several participants asked the researcher about answering these age and gender related questions. Participants were allowed to skip any question they felt uncomfortable about answering. Consequently, numbers (*N*) of participants may vary depending on the variable and statistical analysis.

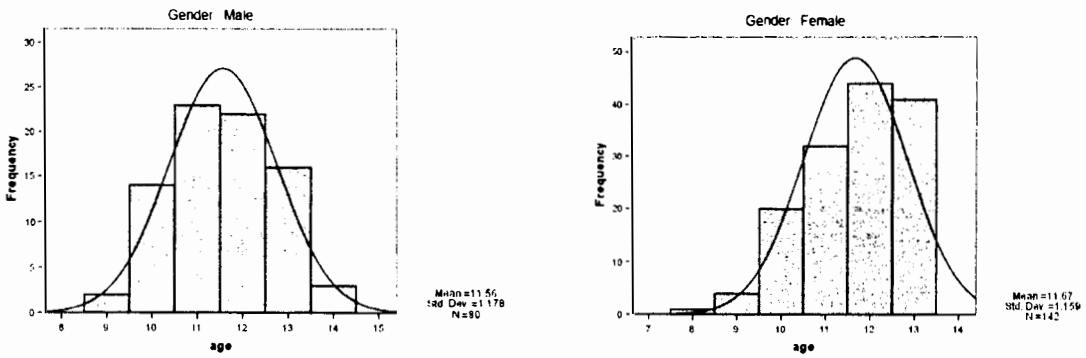
The age of the participants was 8-14 years of age with over 95% of the sample falling into the 10-13 year-old age range. The average age for all participants was 11.63 years (*SD*=1.165, *N*=222). Females (*M*=11.67, *SD*=1.159, *N*=142) were slightly older than males (*M*=11.56, *SD*=1.178, *N*=80).

Table 7: Age Distribution – Females and Males

Age ***N=243***	***Females*** ***M=11.67*** ***SD = 1.159*** ***N=142***	***%***	***Males*** ***M=11.56*** ***SD = 1.178*** ***N = 80***	***%***	***Grand Total*** ***M=11.63*** ***SD = 1.165*** ***N=222***	***%***
8	1	.7	--		1	.4
9	4	2.7	2	2.4	6	2.5
10	20	13.7	14	16.9	34	14
11	32	21.9	23	27.7	55	22.6
12	44	30.1	22	26.5	66	27.2
13	41	28.1	16	19.3	57	23.5
14	--		3	3.6	3	1.2
Total	142	97.3	80	96.4	222	91.4

Females were less evenly distributed by age across the sample than males with *Sku*=.013 for males and females showing negative skewness (.-599) as indicated in Figure 4.

Figure 4: Age Histograms – Males and Females



Data Inspection

The raw dataset was inspected visually and statistically by looking at frequencies, boxplots, histograms and Internet-savvy (IS) scoring distribution. One outlier, a nine year old female with an Internet-savvy score of 47, reported herself to be an *Advanced* Internet user (*Advanced* = 3). This IS score was three standard deviations from the mean of standard scores (z score = -2.997) for *Advanced* users and well outside the normal distribution of scores (Pedhazur, 1997). The case was dismissed from the dataset. With this outlier identified and removed, tests for normality (Shapiro-Wilk) and homogeneity of variance (Levene) tests on the IS scores were as expected (p's >.05). The dataset now consisted of 242 cases.

Missing Values

Missing data can seriously affect statistical results (Greenlees, Reece & Zieschang, 1988; Little & Rubin, 1987). The Internet-savvy scale and its subscales were analyzed for missing values before statistical analyses began on this part of the dataset. All individual item scores were used to calculate overall scale and sub-score totals in the following statistical analyses. Although not excessive, there were missing values in evidence.

Survey data may be missing for a number of reasons including human and computer error (Dillman, 2000; Gerber, 2005). Further, in response to questions during the survey, respondents were advised that they could skip a question that made them uncomfortable. The *missingness* (Gerber, 2005, s. 21) of data can rarely be ignored. Depending on the structure and characteristics of the missing data, the effect may be minimal or may seriously distort statistical outcomes. If missing data is not excessive and random, impact on the results may be minimal. *Missingness* that is concentrated in some critical subset of the data can seriously distort results (p. 23). In the literature, there are many imputation suggestions and algorithmic solutions offered to address this problem (Greenlees, Reece & Zieschang,1988; Little & Rubin, 1987). The most rudimentary imputation method is to fill in the missing values with some randomly selected recorded value for that variable or to simply fill in the variable mean. This is generally not recommended because of the reduction in the variance of the variable (Gerber, 2005, p. 28).

Participants in this study were expected to vary in their responses across the six measures of Creative Expression, Internet Self-Efficacy, Internet Fluency, Social Collaboration, Computer Mediated Communication and Information Gathering. Items making up each dimension were expected to moderately correlate with each other and more strongly correlate with the dimension they were intended to measure. In order to more closely approximate the true value of the unobserved, missing score within a dimension, an average of the dimension's item scores was calculated and substituted for the missing score thereby providing 242 complete cases for the dataset.

Item Analysis and Reliability

An item analysis is necessary to determine whether to retain or remove an item from a scale intended to measure a specific construct (Green, Salkind & Akey, 2000). Items may be removed or replaced based on their correlation and suitability with other items in their respective domains (Krathwohl, 1998). Thirty-eight items were initially developed for the instrument with the expectation that weaker and redundant items would be identified and dropped. Reducing the amount of time to take the survey was also deemed desirable particularly for middle school adolescents. Lengthy surveys can lead to lower survey response rates (Dillman, 2000). Correlation was calculated using Pearson's Product-Moment Correlation Coefficient, *r*. The following benchmarks were used for interpreting the size of the correlation coefficient (Hinkle, Wiersma and Jurs (2003).

Table 8. Correlation Benchmarks

Correlation	***Interpretation***
.90 to 1.00/-.90 to -1.00	Very high positive/negative
.70 to .90/-.70 to -.90	High positive/negative
.50 to 70/-.50 to -.70	Moderate positive/negative
.30 to .50/-.30 to -.50	Low positive/negative
.00 to .30/.00 to -.30	Lack or little positive/negative.

Green et al., (2000) noted that, "for behavioral sciences, correlational coefficients of .10, .30, and .50, irrespectively of sign, are typically interpreted as small, medium, and large coefficients, respectively" (p. 236).

Reliability refers to the consistency of an instrument in measuring whatever it measures (Kathwohl, 1998, p. 435). Reliability coefficients range from 0.0 to 1.0. Measures must be reliable as a precondition to validity (p. 435). Cronbach's Alpha Coefficient was applied to establish item reliability and consistency within each domain and for the overall Internet-savvy scale.

Internet Savvy scale

Item analysis revealed at least one weakly-correlated item in five of the six dimensions, reducing the number of items from 38 to 32. Internet Self-Efficacy was the only dimension in which all original items were retained. The total score reliability coefficient was .91 with dimension score reliability coming in somewhat lower. This is expected since error is spread across fewer items thereby reducing the reliability coefficient. Item analysis and reliability results are reported below by dimension.

Information Gathering (IG)

The first measure considered was Information Gathering. The items making up this domain and their inter-correlations are shown in Table 9.

Table 9: Inter-Item Correlations – Information Gathering

Item	*Question*	*Q1IG*	*Q4IG*	*Q10IG*	*Q14IG*	*Q34IG*	*Q35IG*	*Q37IG*
Q1IG	I would rather get information from the Internet than from a book.	1						
Q4IG	Using a search engine like Google or Yahoo is not a good way to find research information.	.165(*)	1					
Q10IG	I often use the Internet to get data and information for homework assignments, projects and test preparation.	.332(**)	.118	1				
Q14IG	The library is always a better source of information than the Internet.	.519(**)	.351(**)	.230(**)	1			
Q34IG	Trying to find useful data and information on the Internet is a complete waste of time.	.345(**)	.312(**)	.337(**)	.400(**)	1		
Q35IG	Information found on the Internet is highly reliable and accurate.	.352(**)	.272(**)	.247(**)	.426(**)	.433(**)	1	
Q37IG	I frequently use the Internet when gathering research data for school projects.	.338 (**)	.231(**)	.539(**)	.287(**)	.424(**)	.280(**)	1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

A visual inspection and mean calculation of the correlations indicated that item Q4IG had the weakest correlation average ($r = .241$) with other items. Removing this item raised the mean correlation average of the remaining six items to .346, which placed it within Green's medium category of correlation. Cronbach's alpha for Information

Gathering was .77. Reliability results are shown in Table 10 after Q4IG was removed from the dataset.

Table 10: Item-Total Statistics – Information Gathering

M=18.9, SD = 2.99 N=6 α =.77	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q1IG	.550	.342	.730
Q10IG	.472	.323	.750
Q14IG	.529	.361	.736
Q34IG	.559	.327	.733
Q35IG	.488	.278	.747
Q37IG	.529	.373	.735

Computer Mediated Communication (CMC)

Six items were developed to measure the dimension of CMC. Applying a visual inspection and mean calculation of the correlations, item Q19C was identified as the weakest average correlation at $r = .346$. Removing this item raised the mean correlation average of the remaining five items to .504, which placed it just inside of Green's High category of correlation ranges.

Table 11: Inter-Item Correlations – Computer Mediated Communication (CMC)

Item	*Question*	*Q2C*	*Q6C*	*Q17C*	*Q18C*	*Q19C*	*Q25C*
Q2C	I like to use the Internet to chat with friends and family who live far away.	1					
Q6C	I don't like using the Internet to chat (email or instant messaging) with my closest friends.	.719(**)	1				
Q17C	Using the Internet makes it much easier to keep in contact with others.	.587(**)	.507(**)	1			
Q18C	I would rather write a letter to long-distance friends and family than send an email or instant message.	.430(**)	.464(**)	.478(**)	1		
Q19C	If I want to talk with my friends, I always use a telephone or a cell phone.	.371(**)	.409(**)	.413(**)	.229(**)	1	
Q25C	Using instant messaging is a good way to communicate.	.622(**)	.566(**)	.607(**)	.476(**)	.268(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

Cronbach's alpha for Computer Mediated Communication was .86. Reliability results are shown in Table 12 after Q19C was removed from the dataset.

Table 12: Item-Total Statistics – Computer Mediated Communication

M=16.36 SD=3.263 N=5 α=.86	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q2C	.746	.611	.809
Q6C	.702	.558	.821
Q17C	.669	.468	.829
Q18C	.551	.316	.857
Q25C	.705	.507	.820

Internet Self-Efficacy (ISE)

The five Internet Self-Efficacy items were examined next. All correlations were relatively consistent and the overall correlation average was satisfactory at .520. All ISE items were retained.

Table 13: Inter-Item Correlations – Internet Self-Efficacy (ISE)

Item	*Question*	*Q3ISE*	*Q5ISE*	*Q12ISE*	*Q21ISE*	*Q27ISE*
Q3ISE	I would be the last person to ask if you wanted to know something about the Internet.	1				
Q5ISE	I am **not** very confident when navigating the Internet.	.335(**)	1			
Q12ISE	I am sure of my abilities when answering questions about the Internet.	.379(**)	.373(**)	1		
Q21ISE	I consider myself to be a capable Internet user.	.330(**)	.501(**)	.514(**)	1	
Q27ISE	At times I feel anxious and unsure of myself when using the Internet.	.321(**)	.482(**)	.294(**)	.474(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

Cronbach's alpha for Internet Self-efficacy was .77 and Reliability results are shown in Table 14.

Table 14: Item-Total Statistics

M=16.29 SD = 2.482 N=5 α=.77	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q3ISE	.448	.210	.756
Q5ISE	.575	.352	.708
Q12ISE	.519	.322	.728
Q21ISE	.624	.425	.694
Q27ISE	.526	.318	.725

Creative Expression (CE)

The scale items measuring Creative Expression were investigated as above. Item Q16CE was identified as the weakest item (r = .259) and was removed, improving the correlation average of the remaining items (N=5) to .426. This correlation coefficient placed it in the high medium range of Green's index of correlation ranges.

Table 15: Inter-Item Correlations – Creative Expression

Item	*Question*	*Q7CE*	*Q9CE*	*Q11CE*	*Q16CE*	*Q20CE*	*Q22CE*
Q7CE	I like to exhibit my creative work (artwork, stories, photos, videos) on the Internet.	1					
Q9CE	Being able to creatively express my ideas and thoughts on the Internet (blog, chat room, discussion board) is inspiring to me.	.560(**)	1				
Q11CE	I would **not** want to display my creative work (stories, art, photos) online to anyone including family or friends.	.470(**)	.501(**)	1			
Q16CE	I **rarely** change my personal online settings (color, background, name or avatars) to express my personality.	.210(**)	.312(**)	.180(**)	1		
Q20CE	I enjoy using different media (audio, video, image, animation) and combining them into my own creation.	.450(**)	.452(**)	.390(**)	.322(**)	1	
Q22CE	The Internet is **not** a good place to display or share personal artwork, poetry, audio or video creations.	.477(**)	.547(**)	.506(**)	.272(**)	.325(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

Cronbach's alpha for Creative Expression was .812. With the number of Creative Expression items totaling five, reliability results are shown below in Table 16..

Table 16: Item-Total Statistics – Creative Expression

M=12.88 SD=3.616 N=5 a=.812	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q7CE	.634	.408	.765
Q9CE	.676	.462	.752
Q11CE	.595	.360	.777
Q20CE	.500	.269	.804
Q22CE	.598	.389	.777

Internet Fluency (IF)

The Internet Fluency domain consisted of seven items. Questions Q26IF and Q28IF were shown to have weak average correlations with *r's* equal to .225 and .211 respectively. Dropping these items reduced the item count to five and raised the group correlation (*r*) average to .325.

Table 17: Inter-Item Correlations – Internet Fluency (IF)

Item	*Questions*	*Q8IF*	*Q13IF*	*Q26IF*	*Q28IF*	*Q29IF*	*Q30IF*	*Q31IF*
Q8IF	When constructing web pages, I know how to modify the HTML code if necessary.	1						
Q13IF	I have no idea what a podcast is.	.314(**)	1					
Q26IF	Using different Internet applications - often at the same time - makes me more productive in everything I do.	.201(**)	.304(**)	1				
Q28IF	I am often asked by my peers, siblings and adults for assistance on the Internet.	.221(**)	.122	.151(*)	1			
Q29IF	If someone changed my browser's (Internet Explorer, Firefox, Safari) homepage, I would not know how to reset it.	.377(**)	.416(**)	.258(**)	.180(**)	1		
Q30IF	I am considered an "Internet Guru" at school.	.372(**)	.269(**)	.196(**)	.260(**)	.358(**)	1	
Q31IF	Transferring web pages, modifying images and converting audio or video files are easy and fun tasks for me.	.470(**)	.262(**)	.243(**)	.337(**)	.373(**)	.504(**)	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Cronbach's alpha for Internet Fluency was .74 and Item-Total statistics are reported in Table 18.

Table 18: Item-Total Statistics – Internet Fluency

M=12.19, SD=3.5, N=5 A=.742	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q8IF	.526	.295	.689
Q13IF	.428	.209	.731
Q29IF	.531	.288	.687
Q30IF	.511	.305	.697
Q31IF	.550	.363	.681

Social Collaboration (SC)

The Social Collaboration scale began with seven items and ended with six. Item-Total Statistics of the seven items are shown in Table 19. Item Q36SC had a weak average correlation of .197 and was removed. The average correlation(*r*) for the rest of the items in the domain rose to .392.

Table 19: Inter-Item Correlations – Social Collaboration (SC)

Item	*Question*	*Q15SC*	*Q23SC*	*Q24SC*	*Q32SC*	*Q33SC*	*Q36SC*	*Q38SC*
Q15SC	I learn much better when I can interact with others on the Internet.	1						
Q23SC	I would never consider joining an online study group.	.427(**)	1					
Q24SC	Working with others toward a common goal is very difficult to do online.	.412(**)	.362(**)	1				
Q32SC	I regularly share images, music and/or video links with my online friends.	.439(**)	.316(**)	.329(**)	1			
Q33SC	I would **not** be interested in using an online study group to work with others on a school assignment.	.382(**)	.603(**)	.437(**)	.305(**)	1		
Q36SC	I enjoy assisting others in learning how to use the Internet.	.204(**)	.189(**)	.205(**)	.157(*)	.164(*)	1	
Q38SC	It is more interesting and fun to work with others online than by myself.	.558(**)	.405(**)	.431(**)	.350(**)	.488(**)	.262(**)	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Reliability for Social Collaboration was calculated to be .80 based on six items remaining in the Social Collaboration dimension as shown in Table 20.

Table 20: Item-Total Statistics – Social Collaboration (SC)

M=14.67 SD=3.971 N=6 A=.80	*Corrected Item-Total Correlation*	*Squared Multiple Correlation*	*Cronbach's Alpha if Item Deleted*
Q15SC	.608	.414	.763
Q23SC	.577	.405	.770
Q24SC	.536	.294	.780
Q32SC	.453	.230	.801
Q33SC	.602	.452	.764
Q38SC	.611	.413	.762

Reliability - Internet Savvy Scale

Internal consistency of the revised 32-item scale, measured by Cronbach's Alpha was high for the overall scale (α=.918) and moderately high for sub-scales (α range .742 - .848) (See Table 21). Mean scores, standard deviations and alpha coefficients were consistent across all three SEP sessions for total scales and sub-scales and are reported in Table 21. The follow-up sessions (*N*=20) are not shown here.

Table 21: Reliability Coefficients - SEP Sessions

Measures		*Session I N=73*			*Session II N=57*			*Session III N=93*		
	items	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α
Information Gathering	6	19.12	2.445	.633	19.468	2.895	.747	18.53	3.344	.837
CMC	5	16.57	3.005	.860	16.68	3.017	.836	16.10	3.484	.878
Internet Self Efficacy	5	16.70	2.492	.825	15.89	2.657	.681	16.30	2.409	.775
Creative Expression	5	12.95	3.536	.811	13.03	3.692	.788	13.06	3.545	.823
Internet Fluency	5	12.58	3.618	.744	11.68	3.461	.692	12.37	3.523	.778
Social Collaboration	6	14.98	4.104	.826	14.69	4.223	.819	14.52	3.834	.789
Internet Savvy Scale	**32**	**92.90**	**13.886**	**.910**	**91.44**	**14.686**	**.910**	**90.88**	**14.993**	**.926**

Summary mean scores, standard deviations and reliability coefficients by dimension are shown in the table below.

Table 22: Mean Scores, Standard Deviations and Alpha - Dimensions

Measures	*All sessions N=242*			
	items	*M*	*SD*	α
Information Gathering	6	18.90	2.99	.772
CMC	5	16.36	3.263	.858
Internet Self Efficacy	5	16.29	2.482	.765
Creative Expression	5	12.88	3.616	.816
Internet Fluency	5	12.19	3.503	.742
Social Collaboration	6	14.62	4.004	.808
Internet Savvy Scale	**32**	**91.24**	**14.603**	**.913**

Exploratory Factor Analysis

One purpose of an exploratory factor analysis is to uncover the patterns of relationships among dependent variables and classify them according to a simpler structure (Darlinton, 2005). The construct of Internet-savviness is thought to consist of six domains: 1) computer mediated communication, 2) creative expression, 3) information gathering, 4) Internet fluency, 5) Internet-self efficacy, and 6) social collaboration. To test the proposition that these six domains are independent constructs, the responses to the 32 items of the scale were subjected to a Principal Components Analysis (PCA) to detect the structure of these relationships. The following questions as outlined by Darlington (2005) were used as guidelines:

- How many components are needed to summarize the correlations among variables?
- How might we interpret the components?
- How much variance do the components account for? Which components account for most?
- How well does solution align with theory or expected components solution?

Principal Component Analysis was performed with Varimax rotation in an attempt to uncover simple structure. Both theoretical and empirical evidence was considered when deciding on the number of factors to retain. In each instance, results were evaluated against the following criteria: (a) unrotated factors were required to satisfy Kaiser's (1958) criterion of eigenvalues greater than 1.00, (b) accepted configurations had to account for an appreciable percentage of total score variance (i.e., > 50%) (Kaiser, 1958), (c) solutions should meet Cattell's (1966) minimum scree

requirement, (d) each rotated factor should include at least two appreciable factor loadings (i.e., > 40) (Darlington, 2005; Gorsuch, 1983), (e) no more than 5% of the items should load on more than one factor (Gorsuch, 1983; Stevens, 1996), (g) resultant dimensions should demonstrate good internal consistency, (Gorsuch, 1983; Stevens, 1996), and (h) the final solution should be compatible with the theoretical postulates of the scale (Darlington, 2005, Gorsuch, 1983, Stevens, 1996).

The first attempt at identifying the simple structure of the scale revealed that all item loadings exceeded .40 except for Q32SC, an item in the Social Collaboration dimension index. This scale item, Q32SC, is shown below.

I regularly share images, music and/or video links with my online friends.

The initial rotated factor matrix table is shown in Table 46 found in the Supplemental Tables section.

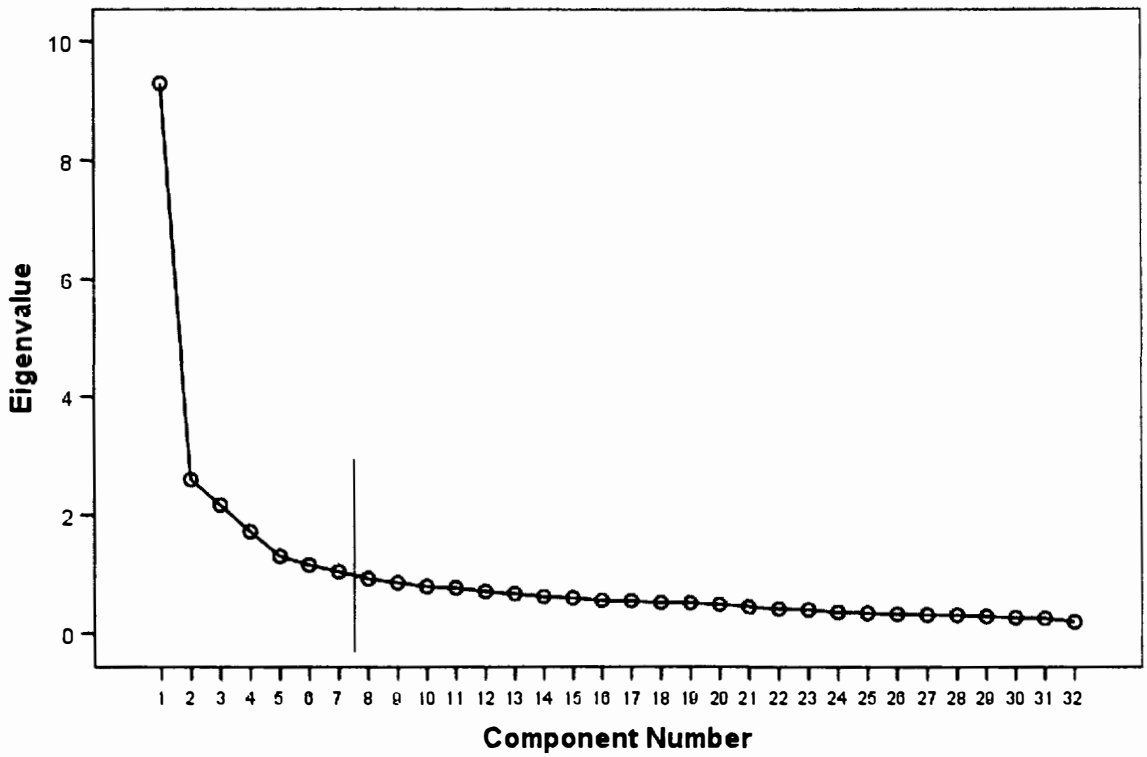
Item Q32SC was removed and the PCA analysis was re-run based on 31 items. Seven components ended up with eigenvalues greater than one with all seven components accounting for 60.462% of the total variance in scores. Table 23 shows the total variance explained from the rotated factor analysis.

Table 23: Total Variance Explained

Component	***Initial Eigenvalues***			***Extraction Sums of Squared Loadings***			***Rotation Sums of Squared Loadings***		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.713	28.107	28.107	8.713	28.107	28.107	3.257	10.508	10.508
2	2.574	8.305	36.412	2.574	8.305	36.412	3.160	10.195	20.702
3	2.132	6.876	43.288	2.132	6.876	43.288	2.892	9.329	30.031
4	1.755	5.660	48.949	1.755	5.660	48.949	2.881	9.294	39.325
5	1.322	4.265	53.214	1.322	4.265	53.214	2.506	8.085	47.410
6	1.174	3.787	57.001	1.174	3.787	57.001	2.447	7.895	55.305
7	1.073	3.461	60.462	1.073	3.461	60.462	1.599	5.157	60.462

The Scree plot in Figure 5 visually shows that the first component accounts for 28.1% of the variance followed by component 2 (8.305%), component 3 (6.876%), component 4 (5.660%) with 6 and 7 contributing close to the same amounts at 3.787% and 3.461% of variance, respectively.

Figure 5: Scree Plot



The Rotated Component Matrix with Item Q32SC removed is shown in Table 24.

Table 24: Rotated Component Matrix – 31 Items

		Component							
		1	2	3	4	5	6	7	
Computer Mediated Communication	Q6C	.800							
	Q2C	.781							
	Q25C	.732							
	Q17C	.693							
	Q18C	.627							
Social Collaboration	Q33SC		.792						
	Q23SC		.692						
	Q38SC		.655						
	Q24SC		.617						
	Q15SC		.530						
Creative Expression	Q7CE		.523	.523					I like to exhibit my creative work (artwork, stories, photos, videos) on the Internet
	Q9CE			.762					
	Q11CE			.638					
	Q22CE			.624					
	Q20CE			.506					
Internet Self Efficacy	Q21ISE				.736				
	Q27ISE				.676				
	Q12ISE				.665				
	Q5ISE				.660				
	Q3ISE				.581				
Internet Fluency	Q31IF					.655			
	Q8IF					.640			
	Q29IF					.632			
	Q30IF					.614			
	Q13IF					.553			
Information Gathering	Q14IG						.783		
	Q35IG						.730		
	Q1IG						.632		
	Q34IG						.575		
	Q10IG							.738	I often use the Internet to get data and information for homework assignments, projects and test preparation.
	Q37IG							.695	I frequently use the Internet when gathering research data for school projects.

Extraction Method: Principal Component Analysis.

Item Q7CE (.523) double-loaded on Component 2 (Social Collaboration) and Component 3 (Creative Expression). Items Q10IG and Q37IG are very similar questions about Information Gathering. One question addresses information needs "for homework assignments . . . ." and the other involves "gathering research data." Both relate to information needs at school which may have caused them to form under a unique component rather than under the more general component (Component 6) of Information Gathering.

Validity

The overall concept of measurement validity is often referred to as construct validity. Construct validity is the unifying framework for evidence regarding whether or not we are measuring what we think we are measuring (Krathwohl, 1998). High reliability, which the Internet-savvy scale has already demonstrated, must be present before validity can be achieved (p. 435).

There are different subtypes of construct validity and several are applicable to this study.

Face Validity

Face validity looks at the operationalization of each item in its domain to see if "on its face" it is a good translation of the construct (Trochim, 2007). During the early development of the scale, a panel of experts made up of Ph.D. students, post-doctorates and professors of Education were asked to take the survey scale and assess its face validity. They provided extensive feedback used to revise and refine the items.

Content Validity

Content validity involves checking the operationalization against the actual content domain for the construct (Kratwohl, 1998; Trochim, 2007). Although the constructs that make up the overall construct of Internet-savviness is deeply rooted in a legacy of learning theory, their current manifestation in a distributed, participative environment is fairly new. Eight Ph.D students majoring in Instructional Technology and well-versed in the use of these new technologies for learning purposes were part of the evaluation team that helped form the survey scale items to ensure that their intent properly translated to their intended construct. The team of evaluators took the survey scale in two different formats. The first format closely approximated the survey scale as currently shown in Appendix A. A second form of the survey scale asked the evaluators to identify the scale question that best translated to the constructs hypothesized for this study. This data was collected and used to further refine the measurement items.

Criterion Validity

Concurrent validity assesses the scales' ability to distinguish between groups compared to theoretical expectations. The scale items demonstrated the ability to discriminate and converge on characteristics that provided correspondence to the respondents' self-reported levels of expertise. Participants were asked to rate their level of expertise on a three-point scale: *Beginner*, *Intermediate*, and *Advanced* (Appendix B, Question 42). Respondents who rated themselves as *Advanced* had higher IS scores. Mean differences (see Table 25) in Internet-savvy scores were statistically significant by group. Correlation between Internet-savvy scores and the self-reported ratings was .546,

a high correlation given the effects of other mediating variables on Internet-savvy scores (Green et al., 2000).

It was expected that *Advanced* users would score better than either *Intermediate* or *Beginners*. *ANOVA* results show that there were significant differences in the scores obtained by the three groups. *ANOVA* was used to confirm this prediction F (2,237) = 43.779, $p < .001$) with *Beginners* (M =75.20, SD = 16.50, N = 17) scoring lowest, followed by *Intermediate* users (M = 87.70, SD = 11.0601, N=141) and the *Advanced* group scoring the highest (M = 101.40, SD = 11.498, N=82). The average score for all three groups was 91.45, SD=14.240, N = 239 with three respondents failing to rate themselves. A Post-Hoc test analysis was conducted using Tukey's *Honestly Significantly Different* (HSD) test. These results showed statistically significant differences between the *Beginners*, *Intermediate*, and *Advanced* groups, with all p's < .001.

Table 25: IS Scores by IS User

Beg/Int/Adv	*M*	*SD*	*N*
beginner	75.20	16.500	17
intermediate	87.70	11.601	141
advanced	101.40	11.498	81
Total	**91.45**	**14.240**	**239**

Multivariate Analysis

A *MANOVA* was conducted to further examine differences in means across the dimensions with dimension scores as outcome variables against the three groups, *Beginner*, *Intermediate*, and *Advanced*. These results are shown below.

Table 26: Means & Standard Deviations by Group and Domain

Domain	*Beginner (N=17) M,SD*	*Intermediate (N = 141) M,SD*	*Advanced (N=82) M, SD*	*Total (N=220) M,SD*	*F (2,237)**
Information Gathering	16.14, 4.167	18.51. 2.677	20.17, 2.659	18.91, 2.991	18.146
Communication	13.20, 4.586	16.03, 3.142	17.61, 2.510	16.37, 3.262	16.698
Internet Self Efficacy	13.47, 1.7	15.65, 2.207	17.99, 1.941	16.30, 2.475	49.391
Creative Expression	10.94, 3.344	12.17, 3.328	14.51, 3.601	12.88, 3.620	15.029
Internet Fluency	8.65, 2.178	11.21, 2.770	14.57, 3.383	12.18, 3.477	46.347
Social Collaboration	12.81, 4.028	14.12, 3.567	15.88, 3.383	12.18, 3.477	7.330

* $p < .001$

A Tukey (HSD) Post Hoc test was conducted on the six domains across the three groups. Differences were statistically significant (all p's < .001) except for Creative Expression and Social Collaboration which failed to show significance between the *Beginner* and *Intermediate* groups.

Discriminant and Convergent Validity

Convergent and discriminant validity work together by demonstrating a correspondence or convergence between similar constructs while at the same time showing measures of constructs that theoretically should not be related to each other are in fact different. Inter-dimensional measurement items correlated moderately high with each other as shown in Table 27 and were strongly correlated with the overall Internet-savvy score.

Table 27: Correlations between Dimension Scores and *Internet-savvy* Score

Correlations						
IS_Total	Information Gathering	Communication	Internet self-efficacy	Creative Expression	Internet Fluency	Social Collaboration
1	.653**	.750**	.639**	.781**	.717**	.792**

**. Correlation is significant at the 0.01 level (2-tailed).

Finally, factors that correspond to what the scale was intended to measure provide evidence of construct validity (Kratwohl, 1998, p.430). The results of the exploratory factor analysis identified a clear structure of clusters of items corresponding to their intended dimensions.

Age and Gender

As outlined in Chapter 2, age and gender was of particular interest in terms of their influence on the factors related to Internet-savviness. Previous research has indicated that the middle school years are particularly formative in terms of attitudes, skills acquisition, and self perception regarding technology (Comber, Colley, Hargreaves & Dorn, 1997; Shoffner, 2006). Internet-savvy scores were examined by gender and age. It was expected that older users would score better than younger users and this was the case, with an *ANOVA* statistic of $F(5,215) = 6.378, p<.001$. Means and standard deviations for age are shown in Table 28.

Table 28: Means and Standard Deviations of IS Scores - Age

age	*Mean*	*Std. Deviation*	*N*
8	61.70	.	1
9	79.76	15.427	5
10	85.77	12.399	34
11	90.77	15.288	55
12	91.52	12.510	66
13	98.38	12.971	57
14	100.33	1.528	3
Total	91.94	14.119	221

A Tukey Post Hoc test (eight year-old eliminated) indicated that the 13 year old threshold was meaningful in terms of the Internet-savvy total scores. Differences in scores of 9- to 12-year-old participants comparisons were not statistically significant but this changed at age group 13 with 13 year-old scores becoming significantly different against younger age groups of 9, 10 and 11 year-olds (all $ps < .05$); 12 year-olds were barely out of significance at $p = .056$.

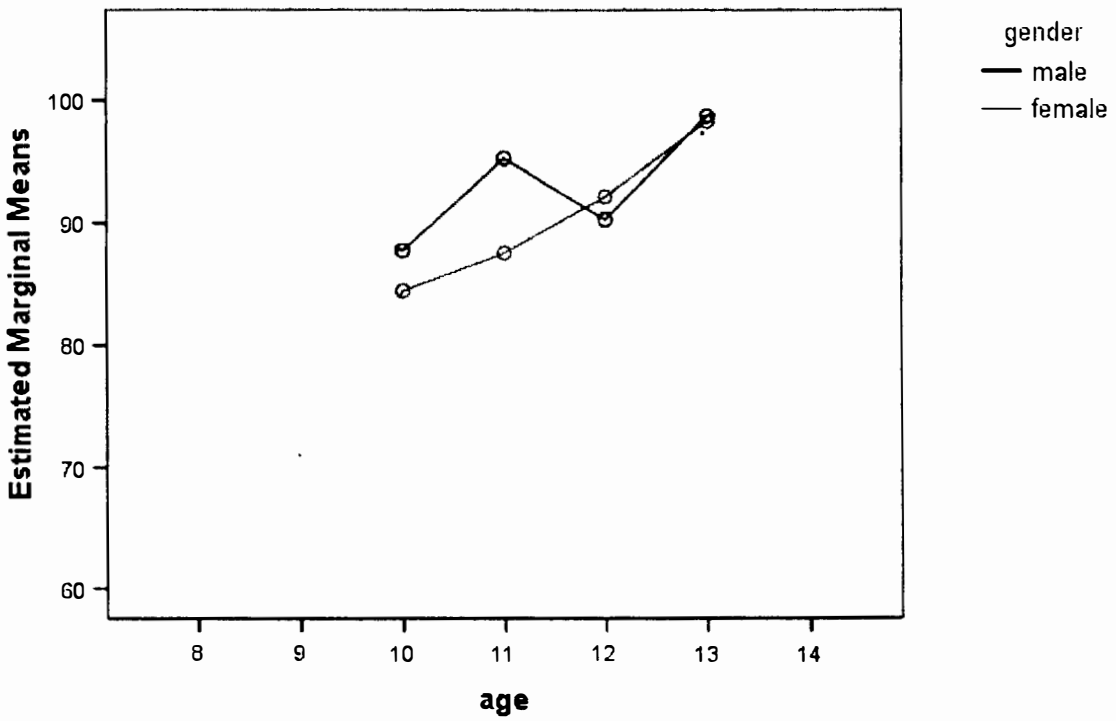
Based on previous research (Eachus & Cassidy, 2002, 2006), it was anticipated that males would score higher than females on the overall Internet-savvy scale. An

ANOVA was conducted to assess for statistically significant differences in the means between males and females. Although males had slightly higher average IS scores (M=93.30, SD=14.360, N=83) than females, (M=91.17, SD=14.424, N=146), this difference was not significant. The youngest (female) member of the sample, age eight, scored the lowest with an IS score of 61.70 and for the 9, 10 and 11 year-old age groups, males scored better than females on overall. However, at age 12, females (M=92.14, SD=11.531) surpassed males (90.28, 14.482) and stayed even at age 13. No females were in the 14 year-old age group but these scores were not statistically different than the 13 year old females. Table 29 and Figure 6 using estimated marginal means are provided to better illustrate this comparison. Eight, nine and 14 year-old respondent scores are removed due to low representation.

Table 29: Means and Standard Deviations – Age & Gender

Gender	***Age in Years***														
	10			**11**			**12**			**13**			**Total**		
	M	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*
Males	87.73	10.58	14	95.25	18.01	23	90.28	14.48	22	98.73	11.58	16	93.36	14.57	80
Females	84.41	13.62	20	87.54	12.30	32	92.14	11.53	44	98.24	13.61	41	90.82	14.27	142
Total	**85.77**	**12.40**	**34**	**90.77**	**15.29**	**55**	**91.52**	**12.51**	**66**	**98.38**	**12.97**	**57**	**91.74**	**14.40**	**222**

Figure 6: IS Total Scores – Age and Gender (10, 11, 12, 13 year-olds)



Online Access, Location & Activity Types

The following section describes the kind of Internet access speed that participants reported having to the Internet, what locations they accessed the Internet from, the kinds of activities they engaged in and the amount of time spent on each activity. These are questions 43, 44, 45 and 46, respectively, and may be found in Appendix B.

Rather than describing Internet access in broadband terms and speed (e.g., kbits\sec, DSL, Cable, dialup) which might be confusing to some participants, response speed was described in terms of "Fast," "Slow" and "Very Slow."

An overwhelming majority of users (76.1%) reported having "fast" access at home while 21% reported slow or very slow access. Only three participants reported having no access to the Internet at home and no one reported not having a computer at

home (see Table 30). An *ANOVA* revealed that there was a statistically significant difference across *IS User* groups, $F(2,234) = 5.325$, $p = .005$. A Tukey Post Hoc test showed significant differences between the *Beginning* and the *Intermediate* and *Advanced* groups (p's < .05)

Table 30: Internet Speed

Speed	*Frequency*	*Percent*
fast	185	76.1
slow	40	16.5
very slow	11	4.5
no access	3	1.2
No computer		
Total	**239**	**98.4**

A simple regression was conducted with IS scores serving as the criterion variable and Internet access speed serving as the predictor variable. Speed was statistically significant in contributing to IS Score variance with $F(1,236) = 17.421$, $p<.001$ and contributed 6.9%, a medium effect size (Cohen, 1988), to the variance in Internet-savviness scores.

Question 44 addressed where adolescents accessed the Internet and how often. Given the multiple response format, the question is shown in Figure 7 for clarification.

Figure 7: Survey Question – Internet Access Location and Frequency

44. Where do you access the Internet and how often do you use it **each week?**

	Never	less than 1 hour	between 1 and 3 hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
school	○	○	○	○	○	○
home	○	○	○	○	○	○
library	○	○	○	○	○	○
a friend's house	○	○	○	○	○	○
community center or church youth group	○	○	○	○	○	○

A *MANOVA* revealed that differences in Internet use at home, $F(2,218) = 21.975$, $p < .001$, and at a friend's house, $F(2,218) = 5.140$, $p = .007$, were significant for IS User groups. Table 31 provides a breakdown of Internet access by location.

Table 31: Time per Week by Location

Internet Access Location	*never*	*%*	*less than 1 hour*	*%*	*1&3 hours*	*%*	*3& 5 hours*	*%*	*5&7 hours*	*%*	*7 or more hours*	*%*	*1 Hour Or more %*
School (N=230)	15	6.2	105	43.4	88	36.4	13	5.4	6	2.5	3	1.2	47.8
Home (N=238)	3	1.2	21	8.7	64	26.4	40	16.5	38	15.7	71	29.3	89.5
Library (N=226)	110	45.5	82	33.9	26	10.7	3	1.2	2	.8	2	.8	14.6
Friend (N=231)	70	28.9	87	36.0	55	22.7	12	5.0	3	1.2	3	1.2	31.6
Com. Center (N=229)	201	83.1	17	7.0	9	3.7	-	-	1	.4	-	-	5.0

Males were more likely to report more Internet use at school and at the library than females, who tended to report more time at home and at the community center. Differences between *Advanced* females (M =4.23, SD =.19) and *Advanced* males (M= 3.2, SD = .22) was just over one hour per week for at-home Internet use.

In regard to overall IS scores, a stepwise regression with .05 set for both acceptance and rejection thresholds in the model revealed that Internet time at home and at a friend's house were good predictors and statistically significant, overall $F(1,219) =$

50.547, $p<.001$. The amount of contribution to Internet-savvy scores was 26.3% with access at a friend's house adding another 5.3%. The overall variance ($R^2=.316$) constituted a large effect size (Cohen, 1988). F statistics R, R^2 and regression coefficients are reported in Tables 49 and 50 in the Supplemental Tables section.

The next question in the survey addressed the types of activities these adolescents were involved in and time spent on each activity. Here is the question posed to the respondents.

Figure 8: Survey Question – Internet Activities

45. The amount of time I spend on the following Internet activities **each week** is:

	none	less than 1 hour	between 1 and 3hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
Chatting with friends or family	○	○	○	○	○	○
Doing something creative like blogging or working on a website	○	○	○	○	○	○
Playing online games	○	○	○	○	○	○
Exchanging images, audio and video files with my friends	○	○	○	○	○	○
Looking up information important to me	○	○	○	○	○	○

Table 32 shows the breakdown of activities and weekly time devoted to each activity.

Table 32: Internet Activities by Participation (%)

Weekly Activities	*never*	*%*	*less than 1 hour*	*%*	*Between 1 & 3 hours*	*%*	*Between 3 & 5 hours*	*%*	*Between 5 & 7 hours*	*%*	*7 or more*	*%*	*1 Hour Or more %*
Chatting (N=232)	48	19.8	65	26.9	49	20.2	26	10.7	27	11.2	27	11.2	55.6
Creative (N=229)	125	51.7	42	17.4	33	13.6	13	5.4	7	2.9	7	2.9	26.2
Playing (N=228)	12	5.0	62	25.6	77	31.8	42	17.4	19	7.9	19	7.9	66.0
Sharing (N=234)	118	48.8	60	24.8	28	11.6	8	3.3	10	4.1	5	2.1	21.8
Looking up (N=233)	20	8.3	70	28.9	80	33.1	37	15.3	22	9.1	4	1.7	61.3

Females led males in chatting and exchanging images. Males led females in doing something creative, playing games and looking up information. Regarding gender, there were significant differences in chatting for females (M=2.14, SD=1.578) over males (M=1.65, SD=1.629) with $F(1,206)=11.162$, p=.038 and playing games with males (M=2.56, SD=1.423) outpacing females (M=2.02, SD=2.02) at $F(1,206)=7.961$, p=.005. Means and standard deviation statistics are shown in Table 33.

Table 33: Internet Activities by Gender

Descriptive Statistics

	gender	*M*	*SD*	*N*
chatting online	male	1.65	1.629	72
	female	2.14	1.578	136
	Total	1.97	1.609	208
Doing something creative . . .	male	1.11	1.306	72
	female	.97	1.366	136
	Total	1.02	1.344	208
Playing games	male	2.56	1.423	72
	female	2.02	1.226	136
	Total	2.21	1.319	208
Exchanging images . . .	male	.90	1.153	72
	female	.97	1.327	136
	Total	.95	1.267	208
Looking up information	male	2.03	1.311	72
	female	1.94	1.052	136
	Total	1.97	1.146	208

Coding for this question: 0 = never, 1 = less than 1 hour, 2 = 1-3 hours, 3 = 3-5 hours, 4 = 5-7 hours, 5 = 7 or more hours.

A comparison by age showed statistical differences in chatting online $F(6,193)=5.435$, p <.001, *doing something creative*, $F(6,193)=3.238$, p=.005, and *playing games*, $F(6,193)=3.577$, p=.002. Table 34 gives the breakdown by age, means and standard deviations.

Table 1: Internet Activities by Age

Gender	*Age in Years*																						
	8			9			10			11			12			13			14			Total		
	M	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*	*M*	*s*	*N*
Chatting Online		-	-	.80	.837	5	1.55	1.588	31	1.60	1.26	47	1.90	1.67	62	2.85	1.61	53	1.00	.00	2	1.99	1.60	200
Doing Something Creative	.	-	-	.20	.48	5	.61	.99	31	1.23	1.52	47	.66	.987	.62	1.53	1.60	43	1.50	.71	2	1.02	1.34	200
Playing Games	.	-	-	1.80	.83	5	2.71	1.53	31	2.64	1.29	47	2.21	1.28	62	1.62	1.10	53	2.00	1.41	2	2.22	1.33	200
Exchanging Images	.	-	-	.20	.447	5	.55	.768	31	1.00	1.46	47	.95	1.34	62	1.28	1.29	53	.50	.71	2	.96	1.28	200
Looking Up Info.	.	-	-	1.40	.548	5	2.00	1.03	31	1.89	1.27	47	1.89	1.15	62	2.08	1.05	53	2.50	2.12	2	1.95	1.123	200
Total	**-**	**-**	**-**	**74.4**	**19.08**	**6**	**85.77**	**12.40**	**34**	**90.77**	**15.29**	**55**	**91.52**	**12.51**	**66**	**98.38**	**12.97**	**57**	**100.33**	**1.528**	**3**	**91.74**	**14.40**	**222**

Coding for this question: 0 = never, 1 = less than 1 hour, 2 = 1-3 hours, 3 = 3-5 hours, 4 = 5-7 hours, 5 = 7 or more hours.

A step-wise regression revealed that *doing something creative*, *exchanging images*, and *chatting online* were statistically significant predictors of IS scores, $F(3,214)=47.282$, $p<.001$. *Doing something creative* contributed 30.0% of the variance in Internet-savviness scores with *Exchanging images* contributing 7.0% and chatting online adding 2.9% for an overall contribution of 39.9% which constitutes a large effect size ($d=1.62$). Tables 51 and 52 in the Supplemental Tables section shows the F statistics, R^2 and R^2 change results.

Question 46 asked about the amount of time spent on the Internet within the content areas of English, Math, Science and Social Studies.

Figure 9: School Disciplines - Internet Time

46. The amount of school time I spend on the Internet **each week** is:

	none	less than 1 hour	between 1 and 3 hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
English	○	○	○	○	○	○
Math	○	○	○	○	○	○
Science	○	○	○	○	○	○
Social Studies	○	○	○	○	○	○

Table 35 provides a breakdown of time spent on the Internet in school by content areas.

Table 35: Content Areas – Class Time spent on the Internet

Content Area	*none*	*%*	*less than 1 hour*	*%*	*1 and 3 hours*	*%*	*3 and 5 hours*	*%*	*5 and 7 hours*	*%*	*7 hours or more*	*%*
English (N=236)	80	33.1	101	41.7	43	17.8	9	3.7	-	-	2	.8
Math (N=236)	107	44.2	84	34.7	39	16.1	3	1.2	2	.8	-	-
Science (N=236)	72	29.8	109	45.0	39	16.1	11	4.5	3	1.2	1	.4
SS (N=232)	65	26.9	88	36.4	57	23.6	10	4.1	6	2.5	5	2.1

Females reported a statistically significant (all p's $< .05$) higher incidence of Internet use in all four content areas. Table 36 shows the results by gender.

Table 36: Content Areas - Gender

Content Areas - Gender				
	gender	*M*	*SD*	*N*
English class	male	.49	.575	79
	female	1.12	.852	144
	Total	.90	.822	223
Math class	male	.38	.647	79
	female	.90	.805	144
	Total	.72	.792	223
Science class	male	.77	.784	79
	female	1.07	.890	144
	Total	.96	.864	223
Social Studies	male	.95	1.049	79
	female	1.29	1.057	144
	Total	1.17	1.064	223

Coding for this question: 0 = never, 1 = less than 1 hour, 2 = 1-3 hours, 3 = 3-5 hours, 4 = 5-7 hours, 5 = 7 or more hours.

English class was the only variable that was a statistically significant predictor $F(1,230)=6.447$, $p=.012$) of variation in IS scores but its contribution was only 2.7%, a low effect size ($d=.33$).

Question 47 shown below in Figure 10 asked about the amount of weekly time spent on the Internet outside of school.

Figure 10: Internet Time Out of School

47. The amount of out-of-school time I spend on the Internet **each week** is:

- ○ none
- ○ less than 1 hour
- ○ 1-3 hours
- ○ 3-5 hours
- ○ 5-7 hours
- ○ 7 hours or more

The results are shown in Table 37.

Table 37: Internet Time Outside of School

Content Area	*none*	*%*	*less Than 1 hour*	*%*	*between 1 and 3 hours*	*%*	*between 3 and 5 hours*	*%*	*between 5 and 7 hours*	*%*	*7 hours or more*	*%*
Internet Use Outside of School N=233	6	2.5	24	9.9	51	21.1	40	16.5	37	15.5	75	31

Ninety-Seven percent of the participants reported using the Internet outside of school. Over 31% reported using it seven hours per week or more. Table 38 provides Means, Standard Deviations and number of participants by gender.

Table 38: Internet Outside of School - Gender

Internet use outside of school			
gender	*M*	*SD*	*N*
male	3.06	1.417	79
female	3.41	1.521	145
Total	**3.29**	**1.491**	**224**

Coding for this question: 0 = never, 1 = less than 1 hour, 2 = 1-3 hours, 3 = 3-5 hours, 4 = 5-7 hours, 5 = 7 or more hours.

Although females averaged a little over 49 minutes more than males on weekly time spent outside of school on the Internet, this was not statistically significant.

The means and standard deviations by age show a pattern of increased Internet use (M=2.83, SD = 1.169 at age 9 to M=3.50, SD=.707 at age 14).

Table 39: Internet Use Outside of School - Age

Internet Use Outside of School - Age			
age	*M*	*SD*	*N*
9	2.83	1.169	6
10	3.47	1.522	34
11	3.30	1.462	54
12	3.22	1.484	65
13	3.25	1.554	55
14	3.50	.707	2
Total	**3.28**	**1.481**	**216**

Coding for this question: 0 = never, 1 = less than 1 hour, 2 = 1-3 hours, 3 = 3-5 hours, 4 = 5-7 hours, 5 = 7 or more hours.

The last question in the section asked participants about their weekly time spent on Internet games. Here is the question:

48. The amount of time I spend playing **online** games **each week** is:
- ○ none
- ○ less than 1 hour
- ○ 1-3 hours
- ○ 3-5 hours
- ○ 5-7 hours
- ○ 7 hours or more

Table 40 presents the data.

Table 40: Time spent on Internet Games

Content Area	*none*	*%*	*less Than 1 hour*	*%*	*between 1 and 3 hours*	*%*	*between 3 and 5 hours*	*%*	*between 5 and 7 hours*	*%*	*7 hours or more*	*%*
Playing Online Games N=234	13	5.4	56	23.1	75	31	44	18.2	28	11.6	18	7.7

Ninety-four percent of these participants reported spending at least some time playing games each week. Over 38% devoted at least three hours per week to online games and almost 8% of them spent seven hours or more on this weekly activity.

Advanced Users and *Internet-savviness*

This last section presents additional data regarding the characteristics and relationships of Internet-savvy youth. Eighty-one participants (33.9%) reported themselves as *Advanced* users of the Internet. *Advanced* users had the highest Internet-savviness scores. For the purpose of this study and for this group of children, *Advanced* users might be considered Internet-savvy. Means and standard deviations for each group of self-reported IS users are reported below.

Table 41: Beginner/Intermediate/Advanced Scores

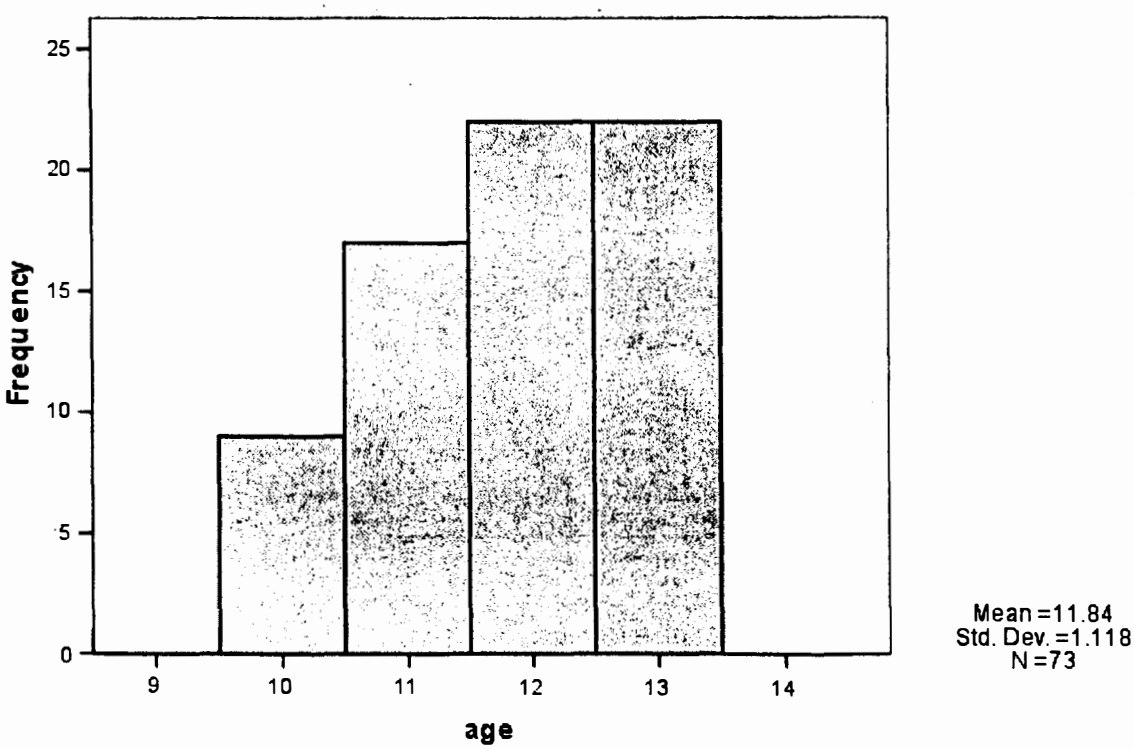
beg/int/adv F(2,236)=50.609, p<.001	***M***	***SD***	***N***
Beginner	75.20	16.500	17
Intermediate	87.70	11.601	141
Advanced	101.40	11.498	81
Total	**91.45**	**14.240**	**239**

Of those respondents reporting gender affiliation, 58.1% of the *Advanced* group were females. However, this was only 29.7% of the total number of females in the sample (N=145). Although smaller in numbers, male *Advanced* users made up a larger percent of their total (N = 83) at 37.3%. The *Advanced* users group were older than the sample average (M= 11.84, SD = 1.118) which can more readily be seen in the histogram in Figure 11. The breakdown by age of the *Advanced* users are shown in Table 42.

Table 42: *Advanced* Users - Age

	Age	*N*	*%*
Adv-Savvy Youth	**9**	2	2.7
N=74	**10**	9	12.2
	11	17	23.0
	12	22	29.7
	13	22	29.7
	14	2	2.7

Figure 11: Histogram – *Advanced* Users – Age (9 & 14 excluded)



Students - Open-Ended Response Summary

The last two questions of the survey were intended to capture the participants' attitudes, beliefs and behaviors regarding the Internet in their own words. The first question was presented to gather information about favorite Internet related activities at school. The second question invited students to offer suggestions for using the Internet to enhance learning. Of the 228 participants who identified themselves by gender, 198 gave responses (86.8%; 81.2% response for N=242). Almost 90% of the males and 85.5% of the females gave answers to the two questions. Thirty-six respondents failed to respond to either one or both of the questions. These last two questions completed the survey which included a total of 62 questions.

Data, Descriptions, and Observations

Although the average time to complete the survey was under 18 minutes, some students took longer and were scrambling to finish as the session ended. It is possible that these students felt rushed to complete the survey and stopped before answering the last two questions. Other students had provided brief answers to the questions. The survey was conducted in the early evening and some participants appeared to have had very busy days. Thus, at the end of the survey, a fatigue factor may have influenced the brevity in answers.

Students who completed the survey early were allowed to access a group of online games. This was a planned activity to avoid boredom, restlessness and unauthorized Internet browsing. It is possible that the activities of these students may have distracted or influenced other students who were still working.

Most of the students, however, appeared to give each question thoughtful consideration and many took several minutes to carefully form their responses. Keying in a sentence or two, pausing and reflecting, backspacing and continuing on to complete their answers was a common observation across all sessions. Chapter 5 presents some exemplars of these kinds of qualitative responses. Here is the first question regarding Internet activities at school:

What are your favorite Internet activities at school?

The responses were first inspected for overriding themes and patterns. The following matrix was developed to capture responses that related to the six dimensions developed in the Internet Savvy scale. A "games" category was added to reflect the overwhelming interest expressed in this activity by these participants. Many responses to both questions were expressed in terms of "Fun" and "Not Fun" so these categories were created to capture responses characterized in this manner. Many participants couched their favorite activities and suggestions in terms of common instructional activities with which they were familiar. These responses were marked under the category, "Traditional Pedagogy." Finally, a miscellaneous category was added to capture all other responses falling outside of the categories outlined above.

Table 43 provides the categories, number of responses and a representative comment that characterized the category theme. A response was often counted under multiple categories.

Table 43: Response Summary – Favorite Internet Activities

Category	*Comment Example*	*Males N=74*	*%*	*Females N=124*	*%*	*Total Response*	*% N=198*
Information Gathering	Looking up things . . .	16	21.6	43	34.7	59	29.8
Computer Mediated Communication	chat and video	2	2.7	11	8.9	13	6.6
Internet Self Efficacy	I really like going on to the Internet and using websites that "test" your knowledge of certain material, such as Brainpop or SOLpass.com. It's much more interesting than reading an excerpt and answering questions, because it doesn't take much energy but is time consuming anyways, making it easy and tedious.	1	1.4	1	.8	9	4.5
Creative Expression	I lie typing my work and poems when I get done with them so family and friends can see.	5	6.8	18	14.5	23	11.6
Internet Fluency	Teaching others new things on about the pc	3	4.1	3	2.4	6	3.0
Social Collaboration	I enjoy doing to online discussion boards between my classmates and me. It makes having a discussion about a topic in school, or on a book we just read a lot easier. I also like going onto blackboard and taking all the practice tests my History teacher makes for us so that we can study for upcoming tests. She also puts up links to other websites so that we can study for tests without her giving us the answers.	1	1.4	5	4.0	6	3.0
Games	Math games. Games that assist learning.	31	41.9	45	36.3	76	38.4
None	I don't use computers at school.	4	5.4	15	12.1	19	9.6
Fun	We just learned how to use Notepad and that was so much fun. We also learned how to make Websites. I also like to play a game called Book Worm. I love going on the computer!	5	6.8	3	2.4	8	4.0
Not Fun	What internet activities? None of them are fun, it's all research, boring...	4	5.4	6	4.8	10	5.1
Educational Web Surfing	nothing really...but I do hate WebQuests.	11	14.9	22	17.7	33	16.7
Traditional Instruction	Studying for tests or SOL's online.	5	6.8	15	12.1	20	10.1
Misc.	Not really favorite, I just go on to do classwork.	13	17.6	3	2.4	16	.8.1

The last question of the survey was:

What suggestions do you have to help your school make better use of the Internet for learning?

The same matrix was used to classify suggestions and responses. "More Technology," "Better Technology." "More Free Time," "Restrictions" and "Technologically Literate Teachers" were added to accommodate multiple responses that clustered around these themes. The results are shown in the Table 44.

Table 44: Response Summary: Suggestions for Internet Use for Schools

Category	*Comment Example*	*M N=74*	*%*	*F N=124*	*%*	*Total Response*	*% N=198*
Information Gathering	Allow us to use search sites like Google and Yahoo	6	8.1	10	8.1	16	8.1
Computer Mediated Communication	Make a online chat system to discuss with other schools.	4	5.4	10	8.1	14	7.1
Internet Self Efficacy	help the kids with all of the surrcing [sourcing? Surfing?].	-	-	-	-	-	-
Creative Expression	-let us use more than just a website that has text; let us view video clips or audio files -teach us how to use HTML or other Web coding systems, because they're quite useful	-	-	3	2.4	3	1.5
Internet Fluency	let us use the computers more offten	3	4.1	4	3.2	7	3.5
Social Collaboration	i think you should create a program where students could chat and work together to solve problems together but they don't necesarilly have to be sitting in the same room	-	-	5	4.0	5	2.5
Games	I think that the students should not only do research, but be able to play games too. The games don't have to be just for fun, they can be educational as long as there is some fun in it.	6	8.1	20	16.1	26	13.1
None	I have no suggestions to how school's use the internet.	4	5.4	13	10.5	17	8.6
Fun	numbr uno, u cant make learning fun so wy try	1	1.4	4	3.2	5	2.5
Not Fun	use it more kids don't always like learning but making it fun and useful gets them in the spirit.	5	6.8	6	4.8	11	5.6
Educational Web Surfing	We could go on more websites that are like coolmath.com that are still education. We could also go on coolmath.com more often.	-	-	5	4.0	5	2.5
Traditional Instruction	We could do any SOLs or similar tests on the computer so we get the results faster. Also, we could do particular games on-line that are related to the subject.	3	4.1	15	12.1	18	9.1
Misc.	I really am not one to say with myself being homeschooled all my life.	6	8.1	3	2.4	9	4.5
More Technology	Make the internet connection faster. At my school, it takes about 1 minute just to load a simple search engine.	7	9.5	10	8.1	17	8.6
Better Technology	get better computers, get more/better programs, teach how to use the computer and use the computers more often	10	13.5	11	8.9	21	10.6
More Free Time	I wish we could use the computerr at school more often.	5	6.8	14	11.3	19	9.6
Restrictions	It would be nice if the school didn't block so many websites. Some of the blocked sites can be very useful. I would also suggest for all of the teachers to include internet activities in their daily activities.	22	29.7	31	25.0	53	26.8
Technologically literate teachers	Make sure the teachers are up to date on how to use the internet. Also, have homework assignments or important information available online so that the students can access it easily from home.	4	5.4	9	7.3	13	6.6

CHAPTER 5

DISCUSSION OF RESULTS

This study investigated the characteristics and behaviors of youth who are distinguishing themselves in how they perceive and use the Internet. In a 2003 study, Levin and Arafeh began to describe these adolescents as being Internet-savvy. They found that between 30% and 40% of 12 to 17 year-old youth fell into this emerging category, differentiating themselves from their parents, siblings and even their peers in attitudes, beliefs, and behaviors regarding the Internet. De Boor and Li's 2007 survey of 1,277 9 to 17 year-old students reported that 31% exhibited passion for the Internet, preferred new media to old, were heavy users of social networking, and fervently produced and edited many different forms of online content. These researchers used the term *non-conformists* as a way to differentiate these students from their peers in regard to how they perceived and used the Internet.

Internet-savviness is presented as a multidimensional and unifying construct. A major objective in this study was to develop an instrument that measured this overarching construct and its constituent dimensions. The validation and results of this effort are discussed in this chapter. Further, relationships between Internet-savviness and other variables of interest are presented. Threaded into the interpretation and discussion in this chapter are the participants' own comments which help to illuminate some of the study's findings.

The sample in this study was made up of academically talented and well-abled middle school students, 8 to 14 years of age. Participants who identified themselves as *Advanced* users of the Internet and who had the highest Internet-savvy scores made up 33.9% of the total sample ($N = 242$). This was in line with the findings of two previous studies mentioned above even though these studies included older teens. One concern before the study began was whether or not the construct of Internet-savviness would emerge in this younger, more homogenous group. The continuing trend of accessing the Internet at an earlier age (Kaiser, 2003; Lenhart et al., 2005) combined with the ready access these participants had to the Internet and their proclivity to use it may have helped the unique factors that make up Internet-savviness to emerge.

Psychometric Properties of the Instrument

This study developed and validated the psychometric properties of a new instrument designed to measure Internet-savviness, a multidimensional, newly-conceived construct. The Internet-savviness (IS) scale developed and used in this study was comprised of 31 items after analyzing scale items for low correlation and redundancy. Reliability coefficients for the dimensions were in the .74 and .86 range, and the overall reliability coefficient for the IS scale was .91, which indicated that the scale had acceptable reliability. Inter-item correlations within the dimensions were moderately high. Inter-dimension correlations were low enough to avoid collinearity but high enough to discriminate users across the dimensions. Not surprisingly, dimension correlations with the overall IS score were high.

Validity

The skills assessment questions were designed to establish evidence of concurrent validity with the IS scale. However, this measure proved to be insufficiently reliable (a = .71), thereby defeating its own case for validity. The skills measure was used for the first time during the main study and missed the refining processes of the pilot study.

A goal for future research would be to improve and validate the Internet-savvy skills measure. A corroborating and independent measure of Internet-savviness would further strengthen the overall construct validity of the IS scale. A reliable and valid skills test would also add further import to the IS scale and provide more practical and insightful information and data into the associations between levels of Internet-savviness and skill levels, which would provide more practical information to teachers and educators.

The dimensions of Computer-Mediated Communication, Social Collaboration Creative Expression, Internet Self-efficacy, Internet Fluency, and Information Gathering emerged as a clear and simple structure of the IS scale scores which, according to Kratwohl (1998, p. 430) suggests evidence of construct validity in the measure. Measurement scores confirmed the self-reported Internet user (IS user) ratings of the participants. Users who rated themselves as *Beginners* scored low across all dimensions and on the overall Internet-savviness score. *Advanced*, or Internet-savvy users, scored the highest. As Chapter 4 indicated, these differences were statistically significant at the dimension and overall score levels.

Exploratory Factor Analysis

The exploratory factor analysis met all conditions enumerated in Chapter 4 including minimum eigenvalues, contribution to score variance, and appreciable factor loadings. The analysis reduced the influence of 31 Internet-savviness measurement items to a simple structure that clearly converged on the six dimensions of the study. Eigenvalues exceeded 1.0 on the seven components that initially emerged and all factor loadings exceeded .50, well above the .40 threshold (Gorsuch, 1983; Stevens, 1996). One item, Q7CE, double-loaded on two components that are closely related, Creative Expression and Social Collaboration. The process of *exhibiting* which was the operative word in this item may have caused the item to load on both components. The threshold of less than five percent of the total items loading on more than one component was met (Gorsuch, 1983; Stevens, 1996). Two items (Q10IG & Q37IG) that formed a seventh component clearly related to Information Gathering. The common element between the two items was gathering information in a school context as compared to the other four items which were less specific. This may have caused the formation of the additional component. The respondents made a distinction in terms of how they view information gathering for school purposes. For example, a female, age 12, responded to "Favorite Internet Activities" by writing, "I enjoy researching at school because that is the work that I have to do. In response to the same question a 10 year-old male said, "What Internet activities? None of them are fun, it's all research, boring..." These two items will be further refined for future use of the IS scale.

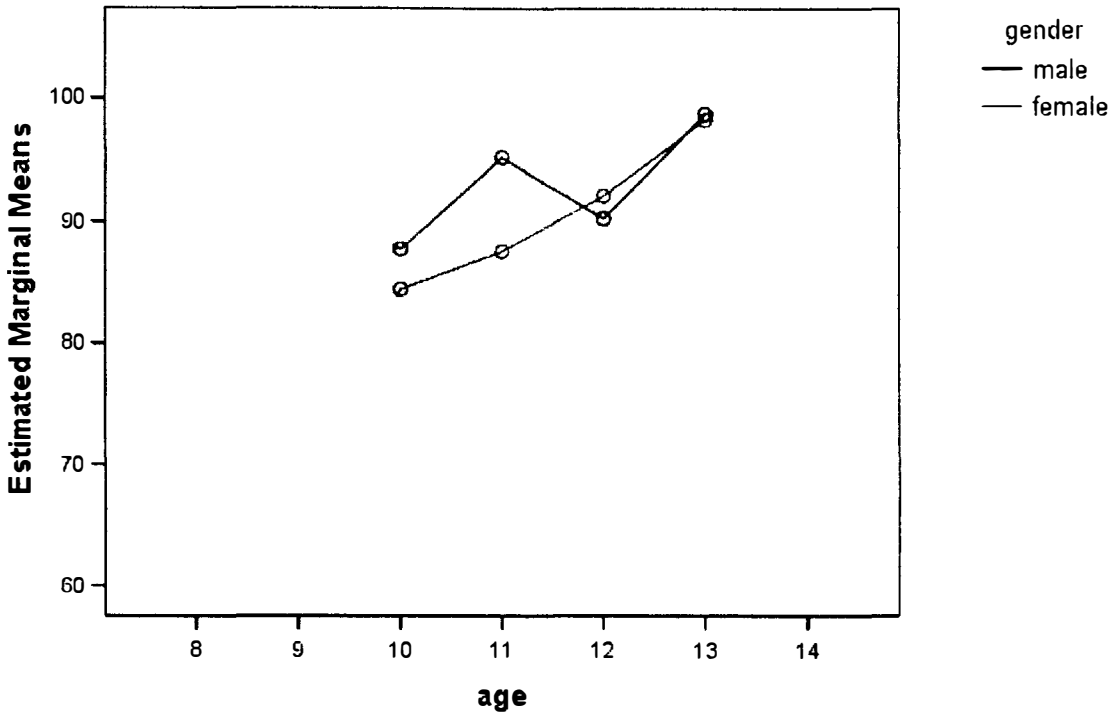
Computer-Mediated Communication was most strongly associated with Internet-savviness scores followed by Social Collaboration and Creative Expression. These three

components contributed to the majority of variance in scores and showed a strong effect size (Cohen, 1988). Internet self-efficacy, Internet Fluency and Information Gathering rounded out the six dimensions of Internet-savviness. All of these dimensions are key elements in acquiring and successfully using critical technology related skills in today's work and learning environments (Cassidy & Eachus, 2006; Bunz, 2004; Labo, Reinking & McKenna, 1998; Karoly & Panis, 2004).

Internet Savviness –Gender and Age

Internet-savvy scores increased with age, but a statistical difference was not detected until age 13. The difference in IS scores was statistically significant for males and for females. Although females started out well below males on overall IS scores, they closed the gap by age 12 and stayed essentially even with the males through ages 13 and 14. Overall, the females showed a more consistent and steeper rate of increase in IS scores as they got older. The IS Total Scores graph (Figure 12) is repeated here to better show this trend.

Figure 12: IS Total Scores – Age and Gender



This is important because it is further evidence that females, at least those in this sample, compare very well with males regarding key technology attributes. Miller, Schweingruber & Brandenburg (2001) concluded that acculturation to the Web has led to a significant narrowing of gender differences in computer use, access and perceived expertise. The results in this study seem to confirm these conclusions.

Mean average IS scores by gender were not statistically significant. This result is encouraging given that middle school is a formative time for females in terms of their attitudes and beliefs regarding technology (Shoffner, 2006). Females have demonstrated an attitude of "I can, but I don't want to" (American Association of University Women, 2000) regarding activities related to technology which have traditionally been male dominated. A logical hypothesis may be that females are finding more Internet applications, online communities of interest, and other Internet related activities that

attract and appeal to them. Additional research would be needed to confirm this. A traditional point of demarcation between males and females regarding technology-related activities has been in game playing (p. 20). Males spent more time playing games but females mentioned playing games more frequently than males as their favorite school activity and were three times more likely to suggest more game play in school as a way to make learning fun and interesting. In response to the "Favorite Internet Activities" question, a 12 year-old female stated, "I love to play on www.iknowthat.com, a place where you learn and play games." Another 10 year-old female suggested that "there should be more fun games that incorporate education but are not only based on them."

Females in this study were more active than males in staying in touch with online friends and sharing images, audio and video files across the Internet. This aligns with previous reporting (Lenhart & Madden, 2005; Lenhart, Madden & Hitlin, 2005; Horrigan, 2007) and further distinguishes unique, Internet-related behaviors of females.

These results may indicate that a critical mass of Internet-related activities of interest to females is emerging. Have females found their "game" on the Internet? Pre-teen and early teen males and females are engaging in all types of social networking activities (de Boor & Li, 2997) and Lenhart et al., (2005) indicated that older, teen females (15-17 years old) were much more active than males in blogging. They also found that blogging activities tended to correlate highly with sophisticated technology and Internet use (p. 7). In terms of content creation activities, these blogging teens (over-represented by older females) showed a much higher incidence of involvement than elite adult users (mostly males; see p. 56). One strategy in relation to STEM related areas might be to use these interests and internally motivating activities as a kind of *Trojan*

Horse, as Salomon (1992) suggests, to attract and engage females and other under-represented groups into these critical fields.

Online Access Speed

The majority of participants (76.1%) enjoyed what they considered to be "fast" access at home with only three participants reporting no Internet access. No one reported not having a computer at home. If "fast" is assumed to be equivalent to broadband access, this figure compares very favorably to a report by Fox & Madden (2005, p. 2) in which 49% of 12 to 17 year-olds had broadband access to the Internet at home. Having sufficient or fast access is obviously a key element to participating in today's most compelling Internet, multimedia enriched applications. Synchronous activities, especially audio and video, require sufficient minimum bandwidth to fully engage these technology medias over the Internet. The adolescents in this study seem to have access to the hardware and bandwidth necessary to accomplish this. These youth spent a lot of time on the Internet at home compared to school and it seems probable that access speed was a contributing factor to this behavior. Access speed was associated as a predictor of Internet-savvy scores and statistically differentiated *Beginners* from *Intermediate* and *Advanced* users. The contrast between these findings and the numerous participants reporting slow speeds, restrictions, and little time to explore the Internet during school is concerning. The participants in this sample were much more likely to have significant bandwidth at home compared to at least one other sample group. As indicated below, home use of the Internet was the most important predictor of IS scores.

Location and Activities

Home and a friend's house were the primary Internet access locations for the adolescents in this study. Over 93% of adolescents in this study used the Internet, which compares favorably to Hitlin and Rainee's (2005) report of 78%. About half, however, accessed the Internet at school less than an hour a week. A great majority of students (89.5%) reported using the Internet at home for more than one hour and 31.6% reported spending at least an hour on the Internet at a friend's house. A significant number of students (29.3%) reported using the Internet at home seven hours or more per week. *Advanced* users spent over twice the amount of time on the Internet (M=3.92, SD=1.322) compared to *Beginning* users (M=1.69, SD=.793). By converting the average item response coding to its temporal equivalent, the difference in time spent per week between the two groups amounted to about 2.5 hours per week, a substantively meaningful amount of time. A small percentage of students accessed the Internet at the library (14.6%) with the community center seeing little Internet use activity for the participants in this study.

These results suggest a contrast between the numerous Internet-accessing opportunities that adolescents in this sample have outside of school compared to in school. With the proliferation of Internet-connected mobile phones and other small devices that adolescents own (Horrigan, 2007), Internet access is approaching ubiquity even for children. The majority of time spent on the Internet is taking place outside of school and away from the guidance of teachers and other education personnel. This is troublesome on several levels. Schools are not proactively using the Internet

instructionally and often block or severely restrict its use in the classroom (De Boor and Li, 2007). Opportunities for modeling and guiding youth on appropriate Internet behaviors and ethical uses are missed. Gathering accurate information and guarding against subliminally manipulated digital media are important skills which require adult guidance and tutelage for appropriate development. "Teachable moments" by example and counter-example that only minimally restricted access to the Internet can provide are lost. The participants in this study cited many reasons for their lack of Internet-related participation in school. Some of the reasons included lack of free time to use the Internet during school hours, inadequate or lack of availability of hardware and software to access the Internet, and the restrictions imposed by filtering software and strict monitoring. Participants made the following remarks regarding these issues:

> I would suggest more reliable and faster computers to help with efficiency of working on projects. As of now, my school has computers that take over 8 minutes to log on to and will frequently lock up or run out of power. If we had better servers, we could get more work done in less time.
>
> Female, 13 years.

> Get faster computers, more time to be able to actually use the computers besides at recess and our once weekly time in the lab, and more educational games.
>
> Male, 11 years

> They could find some type of safe site on the internet, so that we could find some good pictures to put on our powerpoints! (No offense to) Clip Art but their pictures are just like a drawing or sketch, and when someone needs a REAL picture for their GRADED assignment. That does NOT work. That is what could help our school use the internet WISELY.
>
> Female, 8 years

The most frequent comment emerging from these adolescents regarded the restrictions that schools place on using online applications and services commonly used outside of school. Lack of access to productivity tools like Google and the heavy

filtering that is applied on school Internet connections and user computers can be burdensome, especially to youth raised in a "twitch speed" (Prensky, 2001) culture. These reports are consistent with what Levin and Arafeh (2003) reported in *The Digital Disconnect* and a more recent report sponsored by the National School Boards Association (de Boor & Li, 2007). De Boor and Li (2007) reported the following facts on Internet use constraints at the school district level:

- More than nine in 10 school districts (92%) require parents and/or students to sign an Internet use policy. Nearly all (98%) districts use software to block access to inappropriate sites.
- More than 8 in 10 districts have rules against online chatting (84%) and instant messaging (81%) in school.
- More than 6 in 10 districts (62%) have rules against participating in bulletin boards or blogs; six in 10 (60%) also prohibit sending and receiving e-mail in school.
- More than half of all districts (52%) specifically prohibit any use of social networking sites in schools.

At present, schools are struggling with the difficult challenges of using the Internet in a way that is instructionally beneficial and motivating to students. As of 2005, the Department of Education (2005) reported that 99% of public schools were wired for Internet access. Non-authentic and forced online assignments, numerous restrictions that limit access, and lack of free time severely curtail the Internet's use in schools. A 10 year-old female lamented that, "We don't have internet activities that I find fun. One of them is a math site called Rainforest Math, it was to prepare us for the math sol, but they

"forced" us to do it. They said you have to do three little activities, which we found boring."

Levin and Arafeh (2005) found that 34% of students never use the Internet at school (p. 4). This study found that while most students surveyed had used the Internet at school, almost half of them used it for less than an hour a week. The average time these students reported using the Internet at home was over twice the time used at school. *Advanced* users reported using the Internet over two times more than *Beginner* users did in school.

Access at home and at a *friend's house* were strongly associated with higher Internet-savviness scores and self-reported user groupings. Internet use at school was neither statistically significant nor strongly associated with these outcomes.

Internet Activity Types

The majority of participants reported spending at least one hour per week on the following three activities: playing games (66.0%), chatting with friends or family (55.6%), and looking up information important to them (61.3%).

Online Games

The participants in this study were avid game players. Almost all (97.8%) have played a game online, compared to 81% reported by Fox and Madden (2005). Almost 8% reported playing online games for seven or more hours per week. Many of these games are free and incorporate socializing and communication elements in their play spaces. Creative expression often takes the form of character, scenario selection, and color palette for the game space and divergent thinking in terms of problem solving (Gee,

2003). Many educators feel that integrating game play in the classroom is an ideal way to motivate and teach content (Gee, 2003; Prensky, 2001, 2006). Prensky (2006) suggested:

> . . . we must engage them in the 21st century way: electronically. Not through expensive graphics or multimedia, but through what the kids call "gameplay." We need to incorporate into our classrooms the same combination of desirable goals, interesting choices, immediate and useful feedback, and opportunities to "level up" (that is, to see yourself improve) that engage kids in their favorite complex computer games.

Games were a frequent topic in terms of a "favorite Internet Activity" and "Suggestion for Internet Use." Comments often recognized the need for games to focus on structured content in a school context and these participants obviously desired educational games to no games at all. Typical student comments follow: "Going to educational games!!!!!!!!!" - Favorite School Activities, Male, 11 years; "I very much like when we get to play online games that help us learn, but have fun at the same time." - Favorite School Activities, Male, 12 years; "Find some funner games that still help us learn. Don't "force" us to do it, but give us options. The teachers should be more flexible and not "forcing." - Suggestions for School, Female, 10 years.

Chatting Online

Over 11% of the adolescents in this study spent seven hours or more chatting online with friends or family. Given the multitasking abilities of young adolescents (Foehr, 2006) and additional affordances seen in the most common (and free) instant messaging tools today (hyperlinking, attachments, text, audio video capabilities) the process of communicating often involves other related activities such as looking up information in a search window and word processing a homework assignment. Making

plans with friends, talking about homework assignments, joking around and checking in with parents are common threads of communication that teens engage in (Lenhart et al., 2005). A logical notion is that Internet based activities taking place outside of school are non-school related. But young people use the Internet as a way to understand, negotiate and manage what is important in their world and school is important to most teens (Levin & Areheh, 2003). De Boor and Li reported that almost 60% of students who use social networking talk about education topics online and more than 50% talk specifically about schoolwork (2007).

Females were more active in chatting and sharing audio and video artifacts with friends while males were more involved in playing games, doing something creative, and looking up information. Differences in chatting and game playing were statistically significant for gender differences and these themes strongly emerged in the participants' open-ended responses. A 12 year-old female stated, "My favorite internet activities are: email, instant messager, cameras on the apple computers, iTunes, and GarageBand." Another student, a 12 year-old male, made a clear distinction between school time (work) and breaks (game play). "I like to go on games when I have free time in school because it's like a break from all the work they give us."

Doing something creative, exchanging images and chatting online were strongly associated as predictors of Internet-savviness.

School Time on the Internet – by Discipline

The overwhelming majority of participants reported spending less than an hour per week on the Internet during their classes. Math and Science classes saw the least amount of Internet activity. Paradoxically, the strong, common foundation and historical

roots of math and science with the Internet and computers is not an influence in these areas at least for the students in this study. Some comments relevant to integrating the Internet with class content are shown below.

> I think that many online activities could be very helpful with the process of learning. Many times there are student lessons on the Internet that provide students with an alternative way to learn. Sometimes the internet can be used to help students with future tests and quizes.
>
> Suggestions for Internet Use, Female, 11 years

> They should make it easier for all of us to use computers and the internet when we are doing an in class project, not just when we are at home. The school should also make it easier to access sites that they already know posses the information we need we are researching. They should also find sites that have challenging games that re-enforce the things they taught us, but that are actually fun.
>
> Suggestions for Internet Use, name not given, age not given

Student Response Summaries

A large majority of the participants (82%) responded to the questions about favorite Internet activities and using the Internet at school for learning purposes. Personal observations made during the sessions were that many students provided reflexive answers to the questions. Instances of keying, pausing, reflecting and continuing were common. Females in general seemed to be contemplative and careful about their sentencing and structure. A word-count of all respondents reporting their gender showed that females (50 words/person) averaged almost 2.5 times the number of words written compared to males (21 words/person).

Favorite Activities in School

Not surprisingly, the adolescents in this study mentioned games as their favorite Internet activity. In many cases, these children stated that they had very little opportunity or time to use the Internet at school as reported in other sections of this study and from other research. In relation to games, responses included, "I love playing games, which I can't do in school, but I wish I could . . . . even if they were educational games." Information Gathering closely followed Games as a favorite in-school activity in spite of the many restrictions placed on accessing and searching many web sites and in some cases, not being able to use common tools like Google and Yahoo.

Suggestions for Using the Internet in School

Although a greater incidence of Internet based game playing was found to be statistically significant for males over females, the females in this study were three times more likely to suggest games as a useful learning activity. They also seemed more willing than males to compromise in integrating Internet activities, games, and fun with educational objectives. Several respondents spoke of the efficiency of using the Internet in learning and actually recommended sites that combine Internet use with Standards Of Learning (SOL) objectives through game play. Many respondents suggested faster access to the Internet with fewer restrictions and smarter filtering software as a way to significantly improve school Internet use for learning purposes.

Review of Key Findings

Today, many adolescents are using the Internet in ways that may be of keen interest to educators. A superset of these kids, comprising about 30% to 40% of all

Internet-using youth, have eagerly embraced new set of globally distributed technologies that is rapidly diffusing across a digital, connected landscape – largely outside of school.

In order to better understand the actions of these youth and their implications for the classroom, an instrument was developed to measure the overarching, multidimensional construct identified as *Internet-savviness*. Based upon a sample of academically talented and well-abled middle school children, the Internet-Savvy scale was validated against well-known psychometric criteria for measurements of this type. The sub-scale had adequate internal consistency coefficients and high reliability overall. Construct validity was adequately demonstrated. An exploratory factor analysis showed a clear pattern of expected structure based on the scale's dimensions of: 1) computer mediated communication, 2) creative expression, 3) information gathering, 4) Internet fluency, 5) Internet-self efficacy, and 6) social collaboration. Internet-savvy scores corresponded to self reports of *Beginner*, *Intermediate* and *Advanced* Internet users. Thirty-three percent of youth rated themselves as *Advanced* users which aligns with previous research on Internet-savvy teens. Although younger males outscored their female counterparts on the IS scale, the females increased their scores more consistently and rapidly, closing the scoring gap by age 12. Overall, males and females performed equally well on the overall Internet-savviness scale.

Internet-savvy children are using the Internet in ways that are of interest to educators and they are speaking very loudly through their attitudes, beliefs, and behaviors regarding the Internet. Marc Prensky (2006) had this to say about ignoring the *voice* of students:

> As we educators stick our heads up and get the lay of the 21st century land, we would be wise to remember this: If we don't stop and listen to the kids we serve,

> value their opinions, and making major changes on the basis of the valid suggestions they offer, we will be left in the 21st century with school buildings to administer—but with students who are physically or mentally somewhere else.

The participants in this study wanted better access to the Internet at school. They expressed a desire for better Internet resource integration into their content areas, more independent time, and fewer restrictions on how they communicate and collaborate over the Internet at school. Overwhelmingly, they wanted more integration of games into their school day. A message emerged by all of the students regardless of gender and age was to make learning "more fun" as made clear by one 9-year-old female: " . . . and the teachers don't understand that when learning is fun kids actually want to learn. . . ."

Suggestions for Future Directions

The overarching construct of Internet-savviness and its dimensions was conceptualized from a number of disparate but triangulating events, behaviors and classical learning theories. First and foremost, the dimensions are based on the attitudes, beliefs and behaviors of Internet-using teens described in earlier studies (Levin & Arafeh, 2003, Lenhart, et al., 2005), anecdotal reporting and personal observation of adolescent Internet users over the last ten years. Second, global business use of the Internet and the attitudes, beliefs and behaviors of its innovators compared to those of Internet using teens were strikingly similar, which seemed odd but intriguing. Third, over the last 10 years, national reports from government, educational and business sectors have been issuing *Sputnik-era* type warnings about the dearth of individuals with 21st century skills and the lack of preparedness in schools in teaching these new skills (21st Century Work Force Commission, 2000; Horrigan, 2007b; New Media Consortium & Educause LEARNING

Initiative, 2007; U.S. Department of Commerce & U.S. Department of Education, 2002). The enumeration and description of these skills appeared to coincide with what Internet-using teens were eagerly embracing—particularly the Internet-savvy ones. Finally, the correspondence between legacy, social constructivist cognition and learning theory (Bandura, 1986; Bruner, 1963; Csikszentmihalyi & Sawyer, 1996; Dewey, 1897; Labo et. al., 1998; Vygotsky, 1978) updated in a distributed, connected environment (Hutchins, 1995; Pea, 1991; Salomon, 1992) and the attitudes, beliefs and behavioral activities of these Internet-savvy youth was striking.

Most schools face a great challenge in integrating the Internet in their classrooms. Earlier in this study it was suggested that Internet-savvy teens were unknowingly laying out a pedagogical roadmap through their actions and opinions. The similarities and triangulating events from the powerful forces cited above make it important to closely monitor and continue to study Internet-savviness in adolescents. These teens are unknowingly part of a rapidly unfolding drama that will disrupt many institutions and practices. Their attitudes, beliefs and behaviors may be showing us how to finally operationalize and scale a deep legacy of cognition and learning theory that, up until recently, has been difficult to implement beyond more than a few learners at one time. The opportunities for interacting, sharing and exchanging original ideas and objects across a distributed environment may be the cornerstones education needs to jump-start itself into the 21st century.

Part of the solution in successfully accomplishing this is paying careful attention to the attitudes, beliefs and practices of Internet-savvy students. Many of the restrictions schools place on Internet use are antithetical to what adolescents find most compelling

about the Internet (de Boor & Li, 2007). They use the Internet to communicate, create, organize, exchange, collaborate, and schedule their lives – primarily outside of school. These activities should be instructionally embraced in the classroom.

The participants in this study and in others (Levin & Arafeh, 2003; Project Tomorrow, 2007) have made strong statements about quality of Internet access, restrictions and lack of time on the Internet, and the boring "busy work" that substitutes for Internet assignments in school. The good news is that these changes would be relatively easy and painless for schools to make. The price of hardware continues to decline (Svensson, 2007; One Laptop Per Child (OLPC initiative, 2007) and software and services that are popular with Internet-using adolescents are relatively free. Schools are already wired for the Internet and the additional costs to increase bandwidth to schools are nominal. The thorny problem of site appropriateness in schools continues to be challenging. Better software filtering and more enlightened administration of it could alleviate this problem.

Enlightened teachers will often enlist and utilize the experience, talents and knowledge of their students to enrich the learning experiences for all. If we allow them to assist us, Internet-savvy adolescents could become the change agents (Rogers, 1995) that education needs to help manage the transmutation of events that are coming to the classroom in the near future.

Appendix A

Part I - Scale

Internet Survey 2.01 - SEP I

Page 1 of 18

Survey Introduction - page 1

Participant Assent - Please Read

We would like you to complete an online survey so we can learn about what you think of the Internet and how you use it. This survey will ask you about your opinions of the Internet and how you use it. The survey will also ask you about how you access the Internet and where you most often use the Internet.

The survey will take about 15 to 20 minutes to complete. Your answers may help us know more about how children think and use the Internet.

Your answers to the survey questions will not have your name on it, so we won't know what answers you give.

You can skip ANY QUESTION YOU DO NOT WANT TO ANSWER. Also, you can stop doing the study at any time. If you want to stop the study, tell your teacher. Or, simply do not complete the survey. If you start the survey but decide to stop during it, click the "Cancel" button. Your answers will not be included in the results. There is no penalty for stopping.

By clicking on the "I Agree" button, I agree to participate in the research study described above.

I Agree | Cancel

Internet Survey 2.01 - SEP I

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Part I - Page 2

1. I would rather get information from the Internet than from a book.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

2. I like to use the Internet to chat with friends and family who live far away.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

3. I would be the last person to ask if you wanted to know something about the Internet.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

4. Using a search engine like Google or Yahoo is not a good way to find research information.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

5. I am **not** very confident when navigating the Internet.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

Back | Next | Cancel

Internet Survey 2.01 - SEP I

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Part I - Page 3

6. I don't like using the Internet to chat (email or instant messaging) with my closest friends.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

7. I like to exhibit my creative work (artwork, stories, photos, videos) on the Internet.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

8. When constructing web pages, I know how to modify the HTML code if necessary.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

9. Being able to creatively express my ideas and thoughts on the Internet (blog, chat room, discussion board) is inspiring to me.
   ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

10. I often use the Internet to get data and information for homework assignments, projects and test preparation.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 4

11. I would **not** want to display my creative work (stories, art, photos) online to anyone including family or friends.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

12. I am sure of my abilities when answering questions about the Internet.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

13. I have no idea what a podcast is.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

14. The library is always a better source of information than the Internet.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

15. I learn much better when I can interact with others on the Internet.
    ○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 5

16. I **rarely** change my personal online settings (color, background, name or avatars) to express my personality.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

17. Using the Internet makes it much easier to keep in contact with others.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

18. I would rather write a letter to long-distance friends and family than send an email or instant message.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

19. If I want to talk with my friends, I always use a telephone or a cell phone.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

20. I enjoy using different media (audio, video, image, animation) and combining them into my own creation.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 6

21. I consider myself to be a capable Internet user.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

22. The Internet is **not** a good place to display or share personal artwork, poetry, audio or video creations.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

23. I would never consider joining an online study group.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

24. Working with others toward a common goal is very difficult to do online.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

25. Using instant messaging is a good way to communicate.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 7

26. Using different Internet applications - often at the same time - makes me more productive in everything I do.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

27. At times I feel anxious and unsure of myself when using the Internet.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

28. I am often asked by my peers, siblings and adults for assistance on the Internet.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

29. If someone changed my browser's (Internet Explorer, Firefox, Safari) homepage, I would not know how to reset it.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

30. I am considered an "Internet Guru" at school.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 8

31. Transferring web pages, modifying images and converting audio or video files are easy and fun tasks for me.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

32. I regularly share images, music and/or video links with my online friends.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

33. I would **not** be interested in using an online study group to work with others on a school assignment
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

34. Trying to find useful data and information on the Internet is a complete waste of time.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

35. Information found on the Internet is highly reliable and accurate.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Internet Survey 2.01 - SEP I

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Part I - Page 9

36. I enjoy assisting others in learning how to use the Internet.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

37. I frequently use the Internet when gathering research data for school projects.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

38. It is more interesting and fun to work with others online than by myself.
○ Strongly Disagree ○ Disagree ○ Agree ○ Strongly Agree

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Appendix B

Internet Survey 2.01 - SEP I

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Part II - Personal Profile Information - Page 10

In answering the questions below, think of the Internet and the Web as the same.

39. Your zip code:

40. Your Age:

41. Your Gender:
- Female
- Male

42. Compared to my peers, I consider myself to be:
- A beginning Internet user
- An intermediate Internet user
- An advanced Internet user

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Internet Survey 2.01 - SEP I

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Part II - Personal Profile Information - Page 11

43. The type of Internet access I have at home is:
- Fast
- Slow
- Very Slow
- I have no Internet access at home
- My parents won't let me access the Internet at home
- I do not have a computer at home.

44. Where do you access the Internet and how often do you use it **each week?**

	Never	less than 1 hour	between 1 and 3 hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
school						
home						
library						
a friend's house						
community center or church youth group						

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Internet Survey 2.01 - SEP I

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Part II - Personal Profile Information - Page 12

45. The amount of time I spend on the following Internet activities **each week** is:

	none	less than 1 hour	between 1 and 3hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
Chatting with friends or family	C	C	C	C	C	C
Doing something creative like blogging or working on a website	C	C	C	C	C	C
Playing online games	C	C	C	C	C	C
Exchanging images, audio and video files with my friends	C	C	C	C	C	C
Looking up information important to me	C	C	C	C	C	C

46. The amount of school time I spend on the Internet **each week** is:

	none	less than 1 hour	between 1 and 3 hours	between 3 and 5 hours	between 5 and 7 hours	7 hours or more
English	C	C	C	C	C	C
Math	C	C	C	C	C	C
Science	C	C	C	C	C	C
Social Studies	C	C	C	C	C	C

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Internet Survey 2.01 - SEP I

Page 13 of 18

Part II - Personal Profile Information - Page 13

47. The amount of out-of-school time I spend on the Internet **each week** is:

- C none
- C less than 1 hour
- C 1-3 hours
- C 3-5 hours
- C 5-7 hours
- C 7 hours or more

48. The amount of time I spend playing **online** games **each week** is:

- C none
- C less than 1 hour
- C 1-3 hours
- C 3-5 hours
- C 5-7 hours
- C 7 hours or more

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Appendix C

Internet Survey 2.0 - Summer Enrichment Program

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Part III - What do you think?

46. What are your favorite Internet activities at school?
Please key in your answer in the box below.

47. What suggestions do you have to help your school make better use of the Internet for learning?
Please key in your answer in the box below.

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Appendix D

Internet Survey 2.01 - SEP I

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Part III -Skills - Page 14

49. Your friend's computer keeps freezing and you want to help. Which of the following information should you obtain **FIRST?**
   - The make and model number of the computer
   - Error Reporting Log
   - The type of machine, whether it is a laptop or a desktop
   - What your friend was doing when the problem occurred

50. Why is a Web page an effective way to present a report on an animal that you are studying?
   - People like to read reports on computers.
   - People can follow links to additional information, pictures, or animal sounds.
   - People do not have to read the report; they can just look at the pictures and listen to the sounds.
   - People can read a long report on one page by scrolling down so they do not have to go to another web page.

51. Heather knows how to bypass the school's firewall for downloading mp3 files. A classmate asked her to download several hot new songs for his home use. Her most ethical response would be which of the following?
   - "I can't download them because it will break copyright laws."
   - "I'll download them, but you have to promise not to tell anybody."
   - "I'll download them for you, but you can't copy them for anyone else."
   - "I don't know how to download mp3 files."

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Internet Survey 2.01 - SEP I

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Part III -Skills - Page 15

52. Roberta's multimedia project group uses a picture from an online encyclopedia. Which of the following must Roberta's group do?
   - Use the encyclopedia picture freely.
   - Cite the source for the picture.
   - Credit the group members for scanning the picture.
   - List the names of the group members at the end of the project

53. One advantage of using online software tools and simulations to support learning and research is:
   - You can access the software from anywhere providing you have an Internet connection and compatible browser.
   - Online software is much faster and easier to use
   - Online software tends to have more features
   - Online software is always free

54. Using the appropriate instant messaging system, Darrell can do which of the following?
   - Use IM like a telephone
   - Send a text-based message to friends
   - Send a photograph or video file to friends
   - Communicate with more than one person at a time.
   - An Instant Messaging system can do all of the above

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Internet Survey 2.01 - SEP I

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Part III -Skills - Page 16

55. Which of the following can you develop on a webpage so that your friends and family can see or hear your work?
- A text based social studies research report
- A multimedia science project using audio, video and images.
- An audio interview with the local newspaper editor for Journalism class.
- All of the above can be done.

56. Shelby is working on a social studies project about the Civil Rights movement during the '50s and '60s. She can deliver all of the following over the Internet except:
- Create an online digital movie which includes images, animation and audio narratives.
- Search for and use a video clip of a Martin Luther King speech
- Digitally record the personal accounts and insights of local civil rights participants who grew up during these times.
- Present a paper-based report to the teacher

57. Of the following online applications available, which one could be used to personally express your views, share photos and other files and invite others to comment on your work?
- A spreadsheet
- Blog
- Database
- PowerPoint

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Internet Survey 2.01 - SEP I

Page 17 of 18

Part III -Skills - Page 17

58. Students can use the Internet to do which of the following?
- Exchange personal class videos with classes from other countries
- Participate in discussions with other peers, teachers and experts about current events
- Receive a package of food representing Italian cuisine
- Communicate and exchange documents, audio and video files with pen pals in another country

59. Which method is used to cite resource materials in multimedia projects?
- Bibliography of print resources
- Bibliography of three main sources
- Bibliography of online resources only
- Bibliography of all resources

60. When evaluating data and information found on a Web site, which of the following criteria is the most important to be considered?
- Name and credentials of the author or organization.
- The number of graphics in the Web site
- Whether there is an e-mail address
- Professional "look" of the website.

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Appendix E

Internet Survey 2.01 - SEP I

Page 18 of 18

Part IV - What do you think? - Page 18

Please key in your answer in the box below.

61. What are your favorite Internet activities at school?

62. What suggestions do you have to help your school make better use of the Internet for learning?

Back | Done | Cancel

Appendix F

Dear «name»:

My name is Roger W. Geyer. I am a Ph.D candidate in the Curry School of Education, University of Virginia.

I am conducting research on children's attitudes, beliefs and behaviors on the Internet so that we might better understand how to use this important resource for educational purposes. I am writing to ask permission for your child's participation in completing an online survey. This activity will take place during your child's attendance at University of Virginia's Summer Enrichment Program. The survey questions that your child will answer may be pre-reviewed here:

http://www.protopage.com/surveyview

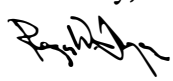
Once the research study has been completed, analysis of summary results will be available to you online upon request. Individual results will not be published.

If you allow your child to participate, they will complete a 15 to 20 minute online survey during their three week session. WE DO NOT ANTICIPATE ANY RISKS to the participants.

You should be receiving a letter and consent form via mail in the next few days. Please read the consent form carefully, sign and return it in the enclosed envelope. You may also give it to an SEP coordinator during your session's Sunday registration.

Thank you for your consideration.

Sincerely,



Roger W. Geyer
Department of Leadership, Foundations & Policy
Curry School of Education
University of Virginia, Charlottesville, VA 22903.
Telephone: (757) 618.6967
Email: rgeyer@virginia.edu

Appendix G

Dear Parent or Guardian:

My name is Roger W. Geyer. I am a Ph.D candidate in the Curry School of Education, University of Virginia.

I am conducting research on children's attitudes, beliefs and behaviors on the Internet so that we might better understand how to use this important resource for educational purposes. I am writing to ask permission for your child's participation in completing an online survey. This activity will take place during your child's attendance at University of Virginia's Summer Enrichment Program. The survey questions that your child will answer may be pre-reviewed here:

http://www.protopage.com/surveyview

Once the research study has been completed, analysis of summary results will be available to you online upon request. Individual results will not be published.

If you allow your child to participate, he or she will complete a 15 to 20 minute online survey during their two-week session. WE DO NOT ANTICIPATE ANY RISKS to the participants.

Please review the enclosed Informed Consent Agreement. If you allow your child to participate, please sign the agreement and give it to one of the program coordinators during your session's Sunday registration. As an additional incentive, we will be drawing for an Apple IPod Shuffle from all of the returned consent forms. The winner will be notified at the end of the session.

Your child will take the survey during the session. He or she will need to assent to the survey by reading the first page (screen) of the survey and clicking on the "I Agree" button.

If you have any questions please do not hesitate to contact me. Thank you very much for your consideration.

Sincerely,

Roger W. Geyer
Instructional Technology
Curry School of Education
University of Virginia
rgeyer@virginia.edu

Appendix H

Parent/Guardian Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study. Your child will also receive an assent form; please review the assent form with your child.

Purpose of the research study:

The purpose of the study is to investigate the attitudes, beliefs and behaviors of children who use the Internet. Even if your child uses the Internet infrequently or not at all, we would still like to have his or her participation. As you know, learning how to use such technologies as the Internet is becoming increasingly important to future academic and career success. The results of this study will help us understand how this powerful resource can be used more effectively in schools. Results of the survey analysis will be available to you upon request.

What your child will do in the study:

If you allow your child to participate, he or she will complete a 15 to 20 minute online survey during their three week session at University of Virginia's Summer Enrichment Program.

There is no logon information required and there will be no attempt to match names with survey data. All data will be anonymous. There will be no way to identify your child while taking the survey or from the survey results.

Your child will be able to skip any question that makes them uncomfortable and they can stop the survey at any time. Participation in the survey is voluntary.

Please feel free to view the survey instrument that your child will be completing at the following link:

http://www.protopage.com/surveyview

Time required:

The survey will take about 15 to 20 minutes to complete.

Risks:

There are no risks associated with participation in this study. Your child may decide that he or she does not wish to take the survey and can stop the survey at any time. Questions can be skipped. All data is anonymous.

IRB Project # 2007-0184
Approved from 6/7/07 to 6/6/08

Benefits:

There are no direct benefits to you or your child for participating in this research study. As you probably know, however, using online based tools and resources has become increasingly important to future academic and career success. The results of this study may lead to a more thorough understanding of how children use the Internet as a learning tool for school and personal use. Insights gained from this study may help us better anticipate and meet your child's expectations and learning needs in the classroom. Further, our research findings will hopefully serve as a guide to a more complete integration of online tools and resources into the traditional school curriculum.

Analysis of the survey's aggregate results will be available upon request.

Confidentiality:

The information that your child will provide in the survey is anonymous. Your child's name will not be collected or linked to the data in any way.

Voluntary participation:

Your child's participation in the study is completely voluntary.

Right to withdraw from the study:

You have the right to withdraw your child from the study at any time without penalty. Simply advise your child not to take the survey.

How to withdraw from the study:

If you want your child withdrawn from the study, simply advise him or her not to take the survey. There is no penalty for withdrawing.

Payment:

Your child will receive no payment for participating in the study.

If you have questions about the study, contact:

Roger W. Geyer
Department of Leadership, Foundations & Policy
Curry School of Education
University of Virginia, Charlottesville, VA 22903.
Telephone: (757) 618.6967
Email: rgeyer@virginia.edu

Bill Ferster, Ph.D.
Director, PrimaryAccess Project
University of Virginia
34313 Welbourne Road
Middleburg, VA 20117
+1 (540) 592-7001
www.primaryaccess.org

If you have questions about your rights in the study, contact:

Tonya R. Moon, PhD. Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 500
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vprgs/irb

Agreement:

I agree to allow my child to participate in the research study described above.

Child's Name _____

Parent's Name _____

Parent's Signature: _____ **Date:** _____

IRB Project # 2007-0184
Approved from 4/7/07 to 4/6/08

Appendix I

Dear «name»:

The first day of the University of Virginia's Summer Enrichment Program is rapidly approaching and I am sure your child is excited about attending!

Recently, we sent a letter and consent form for a research study we are planning. This is a follow-up reminder in the hope that you will allow your child's participation. The study is about children's attitudes, beliefs and behaviors on the Internet and involves a 15-20 minute survey. If you would like to preview the survey, you may do so here:

http://www.protopage.com/surveyview

In case you did not receive your mailing, the original letter and consent form may be downloaded here:

http://people.virginia.edu/~rwg8y/second contact_parent&consent_landmail_flyer.07.2.07.rtf

If you allow your child to participate, please read the consent form carefully, print it out, sign and deliver it to one of the program coordinators during your session's Sunday registration.

We will schedule your child for the survey sometime over his or her two-week stay.

Thank you very much for your participation in this study.

If you have any questions please do not hesitate to contact me.

Sincerely,

Roger W. Geyer
Department of Leadership, Foundations & Policy
Curry School of Education
University of Virginia, Charlottesville, VA 22903.
Telephone: (757) 618.6967
Email: rgever@virginia.edu

Appendix J

Dear <<name>>:

I hope your child returned home safely from the Summer Enrichment Program with wonderful stories to tell about his or her experiences.

As you know, the SEP sessions are chalked full of activities to keep your child motivated and challenged. Because of this, we were not able to survey all eligible children on their use of the Internet. I still have your consent form on file and was wondering if you would allow Rachel to take the survey at home?

The survey may be accessed at:

http://www.protopage.com/netsurvey

Simply click on the Internet Survey 2.01 – SEP I link and the first survey page will come into view.

I am hoping this will not be too inconvenient for you or your child. Rachel's participation would be appreciated and valued.

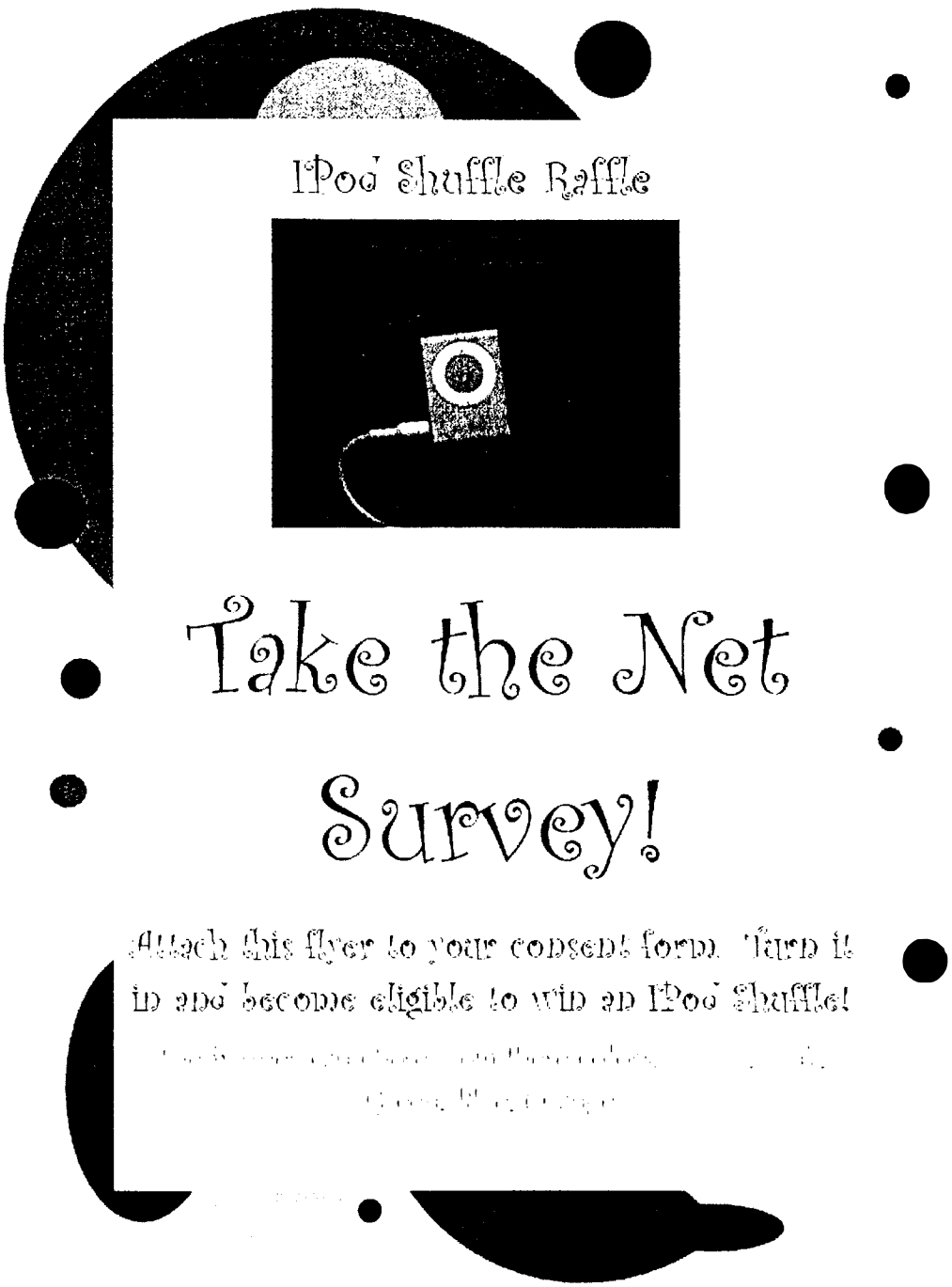
Thank you very much for your support and cooperation!

If you have any questions please do not hesitate to contact me.

Sincerely,

Roger W. Geyer
Department of Leadership, Foundations & Policy
Curry School of Education
University of Virginia, Charlottesville, VA 22903.
Telephone: (757) 618.6967
Email: rgeyer@virginia.edu

Appendix K


IPod Shuffle Raffle
Take the Net
Survey!
Attach this flyer to your consent form. Turn it
in and become eligible to win an IPod Shuffle!

Supplementary Tables

Table 45: Rotated Components Matrix – 32 Items

Dimension		*Component*						
		1	2	3	4	5	6	7
Computer Mediated Communication	Q6C	.799						
	Q2C	.780						
	Q25C	.730						
	Q17C	.683						
	Q18C	.629						
Social Collaboration	Q32SC							
	Q33SC		.786					
	Q23SC		.681					
	Q38SC		.653					
	Q24SC		.619					
	Q15SC		.530					
Creative Expression	Q7CE			.757				
	Q9CE			.637				
	Q11CE			.627				
	Q22CE		.517	.532				
	Q20CE			.500				
Internet Self Efficacy	Q21ISE				.738			
	Q27ISE				.675			
	Q12ISE				.666			
	Q5ISE				.654			
	Q3ISE				.584			
Internet Fluency	Q31IF					.662		
	Q8IF					.633		
	Q29IF					.619		
	Q30IF					.609		
	Q13IF					.538		
Information Gathering	Q14IG						.784	
	Q35IG						.732	
	Q1IG						.627	
	Q34IG						.575	
	Q10IG							.732
	Q37IG							.697

Table 46: Means and Standard Deviations of IS Scores - Age

age	*Mean*	*Std. Deviation*	*N*
8	61.70	.	1
9	79.76	15.427	5
10	85.77	12.399	34
11	90.77	15.288	55
12	91.52	12.510	66
13	98.38	12.971	57
14	100.33	1.528	3
Total	91.94	14.119	221

Table 47: Frequency of Access: Location & Age

Descriptive Statistics

	age	Mean	Std. Deviation	N
access at school	9	1.33	.516	6
	10	1.45	.833	33
	11	1.60	.736	48
	12	1.48	.942	61
	13	1.69	.820	54
	14	1.50	.707	2
	Total	1.55	.832	204
access at home	9	1.67	.516	6
	10	2.91	1.608	33
	11	3.23	1.491	48
	12	3.20	1.424	61
	13	3.78	1.269	54
	14	3.00	1.414	2
	Total	3.26	1.458	204
access at library	9	.17	.408	6
	10	.64	.742	33
	11	.71	.898	48
	12	.80	.749	61
	13	.46	.840	54
	14	1.00	.000	2
	Total	.65	.808	204
access at a friend's house	9	.50	.837	6

	10	.88	.893	33
	11	1.21	1.031	48
	12	1.23	1.101	61
	13	1.11	.984	54
	14	1.50	.707	2
	Total	1.12	1.015	204
access at a community center	9	.17	.408	6
	10	.12	.485	33
	11	.33	.834	48
	12	.10	.300	61
	13	.11	.372	54
	14	.00	.000	2
	Total	.16	.524	204

Table 48: Variance Contribution of Access at Home and Friend's House

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.512[a]	.263	.259	12.490	.263	78.305	1	220	.000
2	.562[b]	.316	.310	12.058	.053	17.070	1	219	.000

a. Predictors: (Constant), access at home

b. Predictors: (Constant), access at home, access at a friend's house

Table 49: Regression Coefficients for At Home and Friend's House

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	74.903	2.070		36.185	.000		
	access at home	5.157	.583	.512	8.849	.000	1.000	1.000
2	(Constant)	72.929	2.055		35.496	.000		
	access at home	4.579	.580	.455	7.900	.000	.942	1.062
	access at a friend's house	3.432	.831	.238	4.132	.000	.942	1.062

a. Dependent Variable: IS_Total

Table 50: F Statistics and R^2 Change – Internet Activities

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*	*Change Statistics*				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.547(a)	.300	.296	11.904	.300	92.399	1	216	.000
2	.608(b)	.370	.364	11.319	.070	23.873	1	215	.000
3	.631(c)	.399	.390	11.082	.029	10.322	1	214	.002

a Predictors: (Constant), Doing something creative . . .
b Predictors: (Constant), Doing something creative . . . , Exchanging images . . .
c Predictors: (Constant), Doing something creative . . . , Exchanging images . . ., chatting online

Table 51: Regression Coefficients – Internet Activities

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	86.535	1.018		85.036	.000		
	Doing something creative . . .	5.876	.616	.544	9.532	.000	1.000	1.000
2	(Constant)	84.951	1.022		83.109	.000		
	Doing something creative . . .	4.101	.692	.380	5.930	.000	.720	1.390
	Exchanging images . . .	3.572	.737	.310	4.846	.000	.720	1.390
3	(Constant)	82.616	1.232		67.054	.000		
	Doing something creative . . .	3.572	.696	.331	5.131	.000	.680	1.470
	Exchanging images . . .	2.844	.755	.247	3.764	.000	.656	1.524
	chatting online	1.783	.549	.199	3.246	.001	.754	1.326

a. Dependent Variable: IS_Total

Table 52: F Tests - Gender

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
gender	English class Internet use	20.333	1	20.333	34.700	.000	.136
	Math class Internet use	13.955	1	13.955	24.624	.000	.100
	Science class Internet use	4.509	1	4.509	6.181	.014	.027
	Social Studies Internet use	5.977	1	5.977	5.380	.021	.024

Table 53: Content Areas - Age

Descriptive Statistics				
	age	Mean	Std. Deviation	N
English class Internet use	8	.00	.	1
	9	.67	.516	6
	10	.76	.890	34
	11	.79	.793	53
	12	1.11	.831	65
	13	.95	.803	55
	14	.50	.707	2
	Total	.91	.822	216
Math class Internet use	8	.00	.	1
	9	.50	.548	6
	10	.56	.613	34
	11	.75	.830	53
	12	.66	.834	65
	13	.85	.803	55
	14	.50	.707	2
	Total	.71	.785	216
Science class Internet use	8	.00	.	1
	9	.50	.548	6
	10	.79	.845	34
	11	1.08	.937	53
	12	1.12	.820	65
	13	.82	.863	55
	14	1.00	.000	2
	Total	.96	.864	216
Social Studies Internet use	8	1.00	.	1
	9	.83	.753	6
	10	1.03	1.359	34
	11	1.23	1.086	53
	12	1.25	1.104	65
	13	1.11	.832	55
	14	1.00	1.414	2
	Total	1.16	1.067	216

Table 54: Playing Games: Gender

Descriptive Statistics			
Dependent Variable:Playing online games			
gender	Mean	Std. Deviation	N
male	2.32	1.167	80
female	2.31	1.412	144
Total	2.32	1.327	224

Table 55: Playing Games - Age

Descriptive Statistics			
Dependent Variable:Playing online games			
age	Mean	Std. Deviation	N
9	2.83	1.329	6
10	2.82	1.290	34
11	2.02	1.367	54
12	2.31	1.236	65
13	2.29	1.275	56
14	3.00	1.414	2
Total	2.33	1.305	217

Supplemental Graphs and Charts

Figure 13: Graph of Access: Location

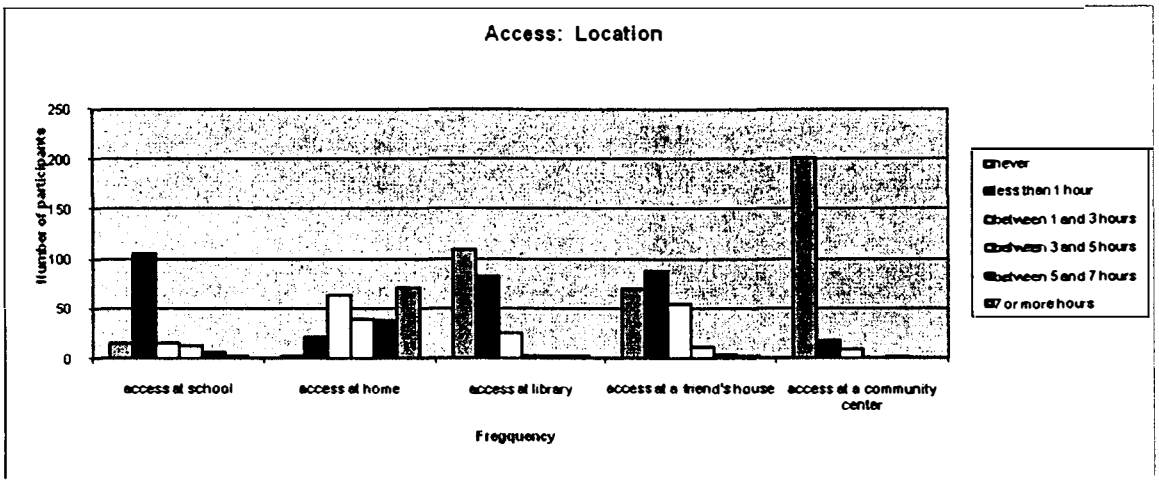


Figure 14: Internet Activities: Frequency

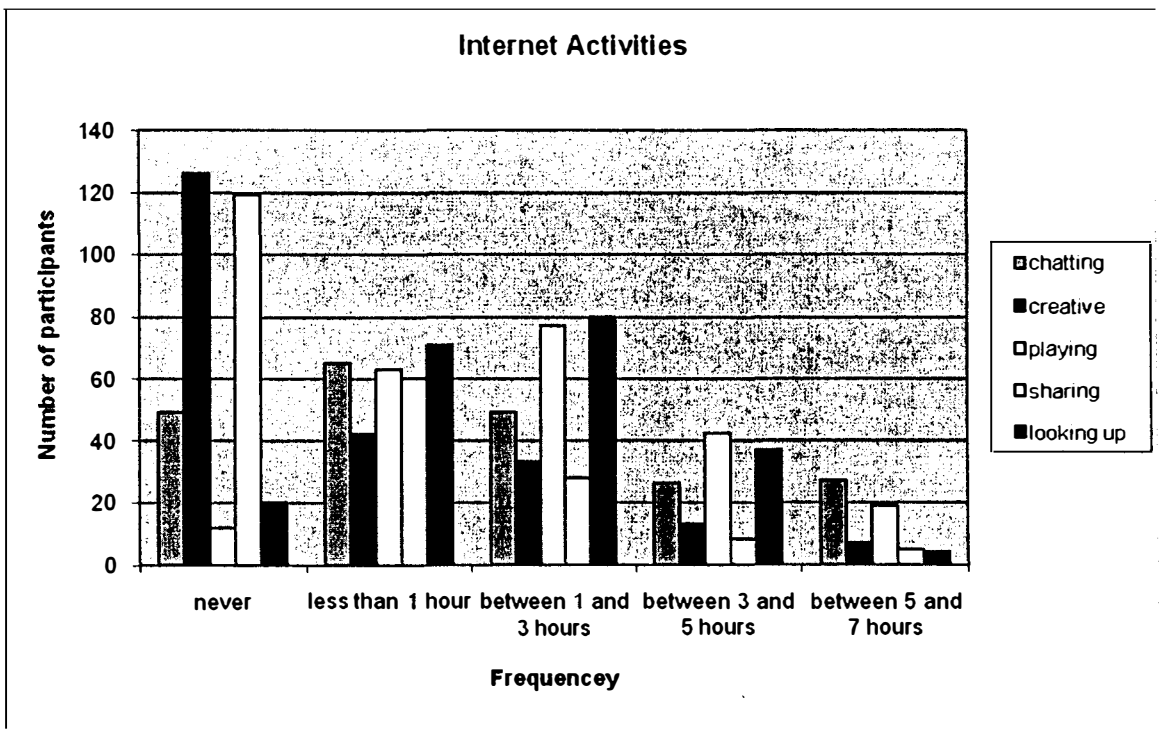


Figure 15: Graph - Content Areas – Class Time spent on the Internet

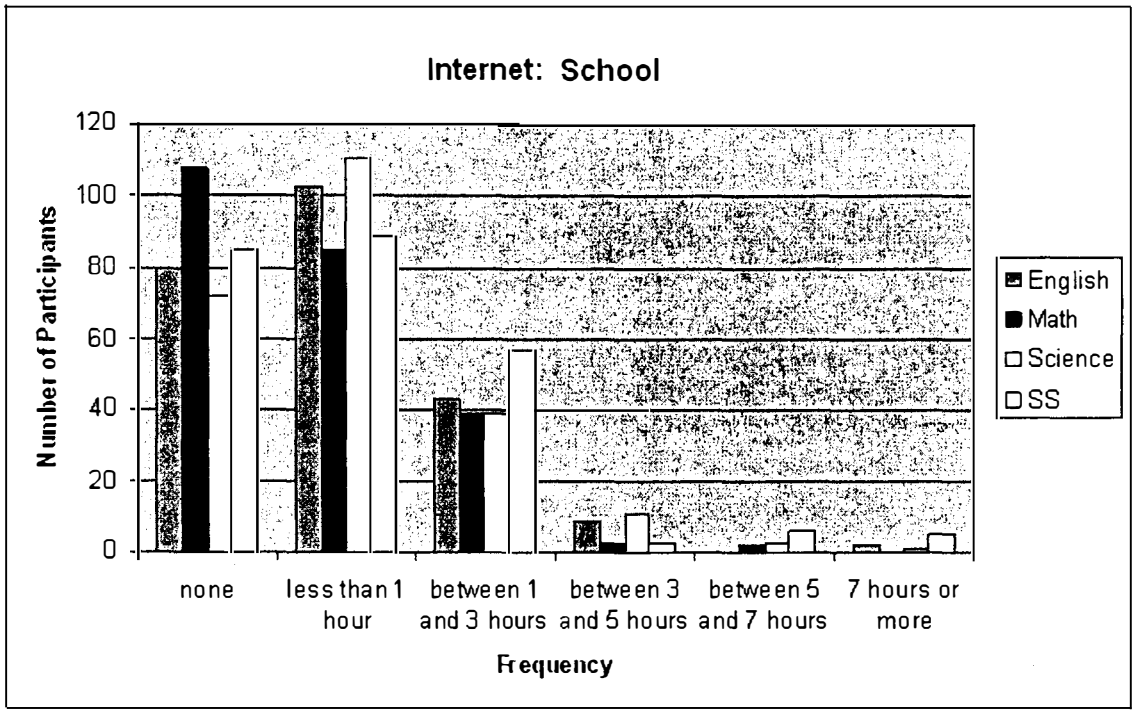


Figure 16: Graph – Internet Use Outside of School

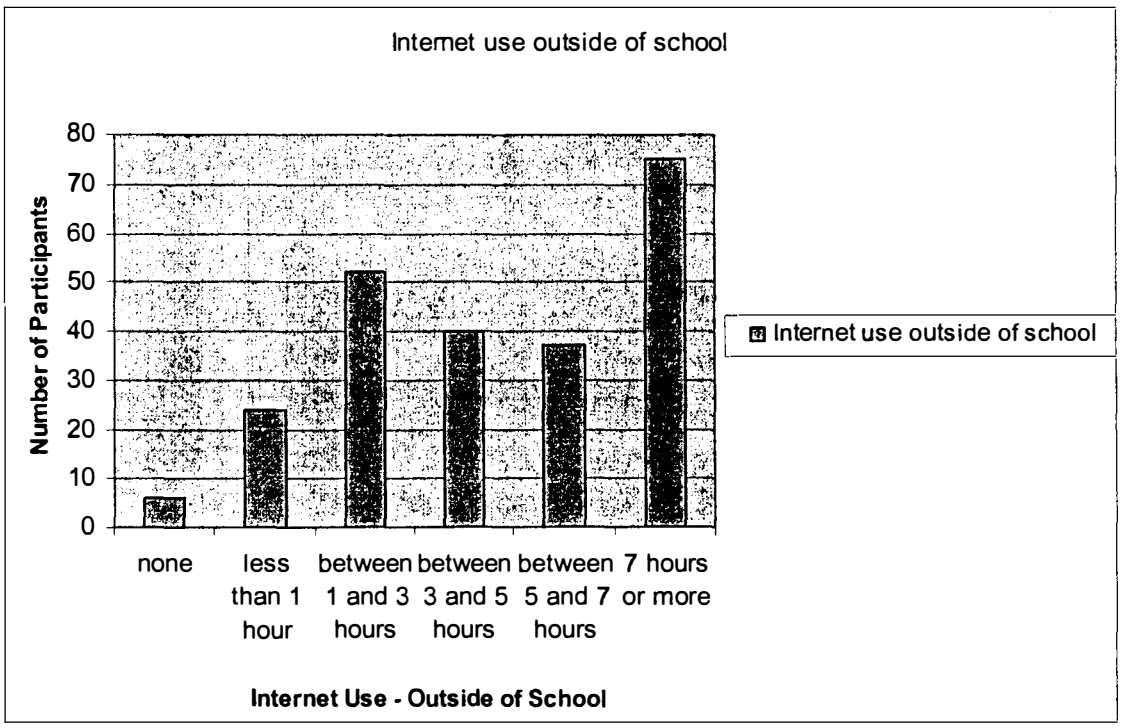
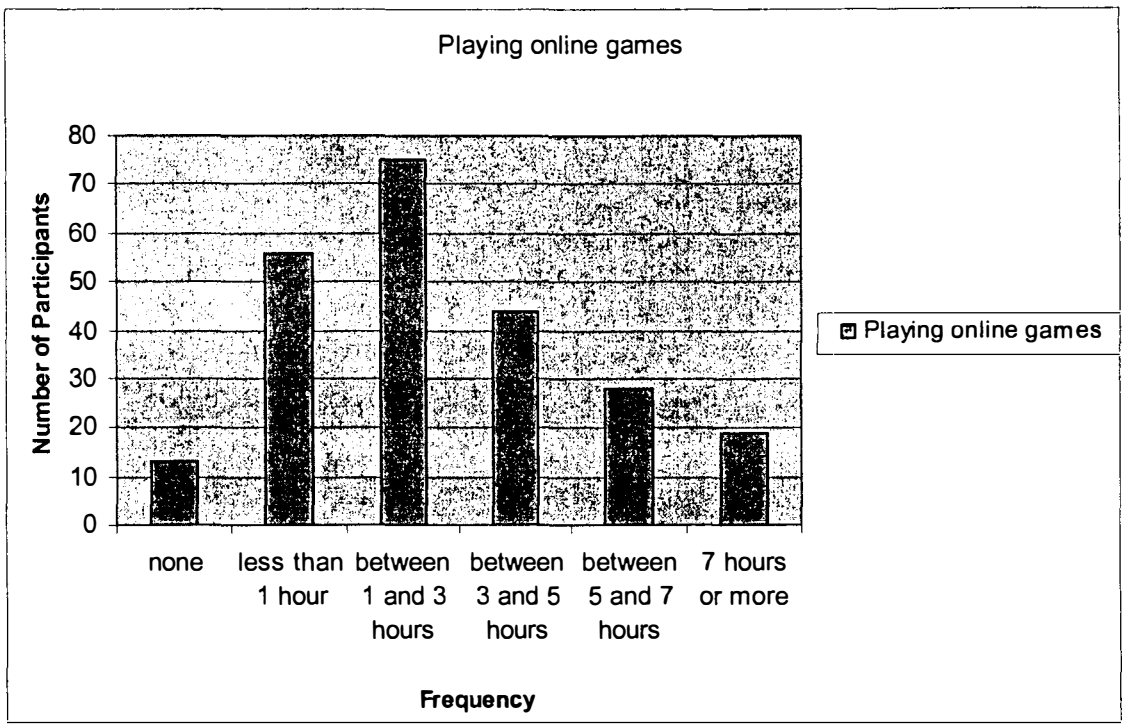


Figure 17: Graph – Online Games



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