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Tap the Screen: Technology Integration in Our Students' Lives

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TAP THE SCREEN:
TECHNOLOGY INTEGRATION IN OUR STUDENTS' LIVES

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NLU Digital Commons Document Origination Statement

This document was created as *one* part of the three-part dissertation requirement of the National Louis University (NLU) Educational Leadership (EDL) Doctoral Program. The National Louis Educational Leadership EdD is a professional practice degree program (Shulman et al., 2006).

For the dissertation requirement, doctoral candidates are required to plan, research, and implement three major projects, one each year, within their school or district with a focus on professional practice. The three projects are:

- Program Evaluation
- Change Leadership Plan
- Policy Advocacy Document

For the **Program Evaluation** candidates are required to identify and evaluate a program or practice within their school or district. The "program" can be a current initiative; a grant project; a common practice; or a movement. Focused on utilization, the evaluation can be formative, summative, or developmental (Patton, 2008). The candidate must demonstrate how the evaluation directly relates to student learning.

In the **Change Leadership Plan** candidates develop a plan that considers organizational possibilities for renewal. The plan for organizational change may be at the building or district level. It must be related to an area in need of improvement, and have a clear target in mind. The candidate must be able to identify noticeable and feasible differences that should exist as a result of the change plan (Wagner et al., 2006).

In the **Policy Advocacy Document** candidates develop and advocate for a policy at the local, state or national level using reflective practice and research as a means for supporting and promoting reforms in education. Policy advocacy dissertations use critical theory to address moral and ethical issues of policy formation and administrative decision making (i.e., what ought to be). The purpose is to develop reflective, humane and social critics, moral leaders, and competent professionals, guided by a critical practical rational model (Browder, 1995).

Works Cited

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Abstract

The focus of this study is to document and describe the integration of technology in the everyday lives of students in Grades 3–8 attending a high-performing public school district in an affluent Chicago suburb. The following research questions guide this study:

- How do students in Grades 3–8 integrate technology into their lives?
- What are the implications of students' technology integration for teaching and learning?
- How can teachers capitalize upon students' technology integration in ways that inform instructional practice?

A review of the literature presents related information in areas that explore the increasingly digital world of our students; curriculum, instruction, and research; innovation, creativity, and learning environments; student social and cognitive development; and student technology use. In this ethnographic study, qualitative research methods are used to interview 55 students in 17 focus groups. An analysis of focus group data is presented in the following categories: technology device access and use; gaming; electronic book readers; television and online video; imposed limits on technology; communicating using technology; and technology in the school environment. Student technology use information is presented in the student voice and is then discussed in the context of improving teaching and learning. This study recommends that both parents and teachers should intentionally seek to understand the technology-enabled pursuits of children to better understand the "whole child." Further, teachers and other school leaders are encouraged to welcome student-owned technology in school and encourage project-based learning opportunities.

Preface

The most valuable aspects of this research project that impacted my leadership practices were the review of literature and the experience of conducting the focus groups and analyzing the data. The extensive process of completing the review of literature made it clear that very little research exists that relates out-of-school student technology use to technology integration in school for students in Grades 3–8. As a technology leader in a progressive education environment where knowing the "whole child" is valued, it has become clear that further research to benefit both teachers and parents is needed to truly be able to personalize learning and differentiate instruction. Also, the review of literature allowed me to learn that virtually no differences exist between "digital natives" and "digital immigrants" (Prensky, 2001a, 2001b), a popular theory that I believe has divided teachers and students as technology users.

The process of conducting focus groups and analyzing data from students in my own district was, by far, the most valuable leadership experience from this study. Although I had predicted a high level of technology access in the community and significant depth of student technology skill and knowledge, the focus groups allowed me to experience this information first hand. Further, as a leader, I am now able to stand behind my recommendations regarding future technology needs of the district with a high level of confidence. This program evaluation has clearly demonstrated the readiness of students in District 36 to proceed with more technology integration opportunities and provides me with targeted information to support recommendations for technology-based teaching and learning systems, programs, and professional development opportunities for teachers, staff, and administrators.

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SECTION ONE: INTRODUCTION

Purpose

By developing a deep understanding of our students' technology experiences, activities, and skills, it is possible to transform the manner in which technology is integrated into teaching and learning. There are already movements by some educators to move beyond project-based learning technology integration models to "challenge-based learning" models that allow students to identify issues based upon interests, design a project, work collaboratively with real-world technology tools, and propose solutions to real-world problems (Johnson, Smith, Smythe, & Varon, 2009). By engaging in this study, other models and methods of classroom instruction emerged from the students. By understanding our students' participation in what Ito et al. (2009) describe as "networked publics," part of our roles as educators can help facilitate a shift to allow our students to "find role models, recognition, friends, and collaborators who are coparticipants in the journey of growing up in a digital age" (p. 353).

Rationale

The study of technology integration as it relates to the everyday lives of school-age children is a relatively new academic pursuit. The large-scale ethnographic study *Hanging Out, Messing Around, and Geeking Out,* (Ito et al., 2009) considers a wide range of youths and young adults, primarily focusing on the ages of 12–19. Ito et al. state that their goal is "to document the everyday lives of youth as they engage with new media and to put forth a paradigm for understanding learning and participation in contemporary networked publics" (p. 339). They acknowledge that, "Despite the widespread assumption that new media are tied to fundamental changes in how young

people are engaging with culture and knowledge, there is still relatively little research that investigates how these dynamics operate on the ground" (p. 2).

Like the research by Ito et al. (2009), this study uses an ethnographic case study approach. The case study characteristics and design employ methods described by Yin (1994). Because this study deals with the "moving target" that is student technology use, interpretations follow realist evaluation traditions: "Realists acknowledge differences between the real world and their particular view of it and try to construct various views of this reality in terms of which ones are relative in time and place" (after Riege, 2003; Sobh & Perry, 2005). Unlike the study by Ito et al. (2009), this study focuses on elementary school-age students in Grades 3–8 (ages 8–14).

Researcher James Paul Gee (2008), who champions the use of video games as learning platforms, states,

> Young people are using the Internet, communication media, digital tools, and membership in virtual communities of practice to develop technical expertise in such areas as digital video, digital storytelling, machinima[1], fan fiction, history and civilization simulations, music, graphic art, political commentary, robotics, anime, fashion design, and nearly every other endeavor the human mind can think of. (p. 48)

One assumption held during this study is that if a teacher has a knowledge and understanding of their students' technology-enabled skills and interests, new teaching and learning opportunities may be possible. On the other hand, Prensky (2010) believes that teachers waste their time learning technology "tools" because tools change too quickly. He believes, instead, that teachers should engage in a "partnering pedagogy" that allows

students to use their skills. He states, “As important as it is for our children to have access to technology tools, for the tools to be at all effective educationally, the right pedagogy...must come first” (p. 7). Thus, to help teachers provide this access and partnering, knowledge of technology tools becomes a necessity.

As a Director of Technology for a high-performing elementary school district in an affluent community, I believe that our students are coming to school from home environments with the most current digital technology available and that our students have extremely high levels of access to current technology devices, services, and resources. I believe that teachers, parents, and the majority of other adults in the lives of students are not fully aware of the types of information students are accessing, the manner in which students use technology devices and services to communicate and learn, and the depth of knowledge and experience students have regarding the uses of technology. For a teacher to truly understand a student, from both educational and broader cultural perspectives, I believe it is important to attempt to learn about student technology use from the students themselves.

Goals

The goal of this study is to document and describe the integration of technology in the everyday lives of students in Grades 3–8 in a high-performing, high-socioeconomic school district. This description will include student uses of technology both out of school and in school.

This topic relates to student learning in a few ways. First, excellent teachers strive to know the interests of their students for the purpose of differentiating instruction and personalizing learning. As stated by Darling-Hammond and Friedlaender (2008), “By

knowing students well, teachers are more able to tailor instruction to students' strengths, needs, experiences, and interests." Technology serves to connect many facets of the lives of our students, including interacting with many forms of media, communicating with friends, building relationships, dealing with home and family, playing games, engaging in creative pursuits, and participating in project and work experiences (Ito et al., 2009). Therefore, it is important that teachers are familiar with the technology-enabled pursuits of their students' lives to more fully understand their students' interests and backgrounds.

Through the use of the Internet and other network-delivered services, possibilities exist for students to bring experiences and skills into the classroom that they have gained and developed on their own using technology modes that may seem second nature to students, but may be unknown or not fully understood by their teachers. In the cases where students are highly skilled, engaged, or otherwise motivated by these outside interests that involve technology, these methods may be worth exploring in the classroom for the benefit of all students.

Research Questions

For the purpose of this study, technology integration includes experiences, activities, and skills in which students engage when using computers, other electronic devices, and services delivered through the Internet and other electronic networks. The primary research question of this study is:

How do students in Grades 3–8 integrate technology into their lives?

Secondary research questions include:

- What are the implications of students' technology integration for teaching and learning?

- How can teachers capitalize upon students' technology integration in ways that inform instructional practice?
- What skills or information do teachers need to better teach and assess students who bring technology experiences, activities, and skills into the classroom?

SECTION TWO: REVIEW OF LITERATURE

Current views in popular culture and academic research assert that the twenty-first century has brought about major changes in both the way students learn and the preparation schools are providing today's future adults. Authors and researchers discuss the complexity of today's 24/7 world (Gee & Levine, 2009; Ito et al., 2009; Prensky, 2001a, 2001; Wagner, 2008a), the increased need for innovation and creativity in the workplace (Johnson, Smith, Smythe, & Varon, 2009; Wagner, 2008a), positive and negative effects of new media on culture (Ito et al., 2009; Lusk, 2010; Prensky, 2006), and the need for collaboration, communication, and technology skills (Dessoff, 2010; Harris, 2009; Ito et al., 2009; International Society for Technology in Education 1998, 2007) as a part of today's learning environments.

Research specific to the area of student technology use has tended to focus primarily upon statistical information regarding ownership of technology gadgets, use of technology services, recreational use of media, and time devoted to various technology-related pursuits (Rideout, Foehr, & Roberts, 2010). A few studies include suggestions for the implementation of current technology in the classroom (NetDay, 2004, 2005; Project Tomorrow-NetDay, 2005; Project Tomorrow, 2006, 2007, 2008, 2011); however, the conclusions of these studies often suggest that teachers bring the tools or services used by students into the classroom without discussing how new innovations may or may not enhance teaching and learning or consider the practicality or appropriateness of the new technology.

One large-scale effort to document new media use from the perspective of students stands out in the literature. The *John D. and Catherine T. MacArthur*

Foundation Reports on Digital Media and Learning are a collection of writings by a consortium of like-minded researchers with the stated purpose to "document youth new media practice in rich, qualitative detail to provide a picture of how young people are mobilizing these media and technologies in their everyday lives" (Ito et al., 2009, p. 4). The paradigm followed by these researchers is to

> capture youth new media practice in a way that is contextualized by the social and cultural contexts that are consequential and meaningful to young people themselves, and to situate these practices within the broader structural conditions of childhood that frame youth action and voice. (Ito et al., 2009, p. 13)

The authors of these reports suggest that new media use by today's youth can be described in seven major categories. Each category is described in detail by lead authors and includes "Media Ecologies" (Horst, Herr-Stephenson, & Robinson, p. 29), "Friendship" (boyd[2], p. 79), "Intimacy" (Pascoe, p. 117), "Families" (Horst, p. 149), "Gaming" (Ito & Bittanti, p. 195), "Creative Production" (Lange & Ito, p. 243), and "Work" (Ito, p. 295). While these categories are suited for the 10–21-year-old age range represented in the MacArthur study, some categories may not be appropriate to describe technology use of students ages 8–14 represented in this study. For example, the topic of dating and relationships described in the "Intimacy" section of the MacArthur report (Pascoe, p. 117) focuses primarily on older teenagers. Similarly, the section about "Work" (Ito, p. 295) provides some examples of younger children engaging in entrepreneurial pursuits, but focuses more on high school and post-high school students.

Two current multi-year studies provide both statistical and trend data regarding student uses of technology. Since 1999 the Kaiser Family Foundation (Rideout, Foehr, & Roberts, 2010) has published three large-scale studies about media use among children ages 8–13. This set of studies reports trend data regarding the uses of technology, but specifically focuses on the recreational uses of media. A more school-focused study of nearly 300,000 students is presented in a Project Tomorrow (2011) report. Project Tomorrow addresses both student technology use and student preferences for how technology might be used in schools from the perspective of the students themselves and has published findings since 2004 (NetDay, 2004, 2005; Project Tomorrow-NetDay, 2005; Project Tomorrow, 2006, 2007, 2008, 2011).

The purpose of this review of literature is to examine the design, implementation, and research behind educational technologies focusing on the creative, cognitive, and social dimensions of teaching and learning (Harvard University, 2012). Several areas of study have been considered in this review of scholarly literature surrounding student uses of technology in the twenty-first century. During this review, five broad categories emerged from the literature, including, Our Increasingly Digital World; Curriculum, Instruction, and Assessment; Innovation, Creativity, and Learning Environments; Student Social and Cognitive Development; and Student Technology Use Statistics. Findings are reported in each of these categories.

Our Increasingly Digital World

As authors discuss technology-related matters aimed at today's children, many offer a set of twenty-first century skills or attributes that they believe students will need to be successful in our increasingly digital world (Partnership for 21st Century Skills,

2011; Walser, 2011; Wagner, 2008a). One writer who has contributed to the discourse has been Prensky (2001a, 2001b), who coined the terms "digital native" and "digital immigrant." Prensky's early work rarely includes scholarly references, despite the fact that his writing is frequently referenced throughout the literature. Many researchers find no evidence that differences between "digital natives" and "digital immigrants" exist (Bennett, Maton, & Kervin, 2008; Guo, Dobson, & Petrina, 2008; Helsper & Eynon, 2010; Kennedy et al., 2008; Lei, 2009). Other researchers study the effect of an increasingly technological world by exploring how technology is used by children in their homes with their families (Horst, Bittanti in Ito et al., 2009).

The Partnership for 21st Century Skills (P21) (2011) presents a framework that defines a set of needs for teaching and learning in the twenty-first century that is comprehensive in its approach. This "Framework for 21st Century Learning" is divided into four parts: Core Subjects and 21st Century Themes; Learning and Innovation Skills; Information, Media, and Technology Skills; and Life and Career Skills. P21 defines the "core subjects" as English, world languages, arts, mathematics, economics, science, geography, history, government, and civics. The core subjects are supported by interdisciplinary themes including global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy. Learning and innovation skills include creativity and innovation; critical thinking and problem solving; and communication and collaboration. Information, media, and technology skills represent the integration of technology skills including information literacy, media literacy, and information and communication digital literacy. A life and career skills framework identifies five areas: flexibility and adaptability; initiative and

self-direction; social and cross-cultural skills; productivity and accountability; and leadership and responsibility. Finally, the P21 framework identifies "critical systems necessary to ensure student mastery of 21st century skills," including twenty-first century standards, assessment, curriculum and instruction, professional development, and learning environments. According to the advocacy group Route 21 (2007), sixteen states, including Illinois, are using the Partnership for 21st Century Skills framework to infuse technology into school programs.

Walser (2011) offers her own list of twenty-first century skills for students including critical thinking, problem-solving, collaboration, written and oral communication, creativity, self-direction, leadership, adaptability, responsibility, and global awareness. She then provides several examples of these twenty-first century skills in action by teachers. Her examples include students as teachers in a Socratic seminar, a challenge-based learning example of a class documenting local wildlife, an entrepreneurial and engineering plan, a movie-based lesson in geometry, and a local environmental project involving science and multimedia to learn about a local endangered river. These accounts offer some concrete examples of successful projects, but do not explicitly address student views of the work or how teachers might wish to design or implement their own versions of this type of instruction.

Wagner (2008a) offers seven "survival skills" for schools to teach students to be successful in the twenty-first century. The seven skills are derived from hundreds of interviews with leaders in the areas of business, nonprofit, philanthropy, military, and education. "Critical thinking and problem solving" underscores the need for workers "to think about how to continuously improve their products, processes, or services" (Wagner,

2008b). “Collaboration across networks and leading by influence” describes how workers must work together locally and across the globe in virtual teams. “Agility and adaptability” explains that the ability to learn new skills is more important than current technology skills because processes and jobs change over time. The survival skill of “initiative and entrepreneurship” warns of risk aversion and encourages workers of the twenty-first century to develop an entrepreneurial culture. “Effective oral and written communication” includes using verbal, written, and presentation skills in a clear and concise manner to be able to focus and communicate important points. Because “employees in the 21st century have to manage an astronomical amount of information daily,” students must learn to access and analyze information effectively. Finally, Wagner believes that “curiosity and imagination” involves asking the right questions and developing students’ capacities for imagination, creativity, and empathy (Pink, 2005). Wagner (2008b) believes that schools “need to use academic content to teach the seven survival skills every day, at every grade level, and in every class.”

Kennedy et al. (2008) studied first-year college students labeled as “digital natives” as defined by Prensky (2001a, 2001b) on the basis of their age and found that while some students embrace current technology tools, the researchers found no “universal student experience” regarding the preferences and uses of technology tools such as computers, mobile phones, email, and other technology services and devices. The researchers found high diversity in technology use and competence among first-year college students and that “core technology based skills do not necessarily translate into sophisticated skills with other technologies or general information literacy” (p. 117). Kennedy et al. (2008) were not alone in their observations and findings.

Lei (2009) studied pre-service teachers born in 1989, defined by Prensky (2001a, 2001b) as "digital natives," and found that although these pre-service teachers used technology extensively in their lives, use was focused mainly on online social media, Internet surfing, and using technology for school projects. In general, these pre-service teachers did not use their previously learned skills and experiences to integrate technology into their teaching methods to help students learn, even though they fully recognized the importance of using technology in their classrooms. Lei provided several possible suggestions for institutions to help pre-service teachers prepare to effectively integrate technology.

Bennett, Maton, and Kervin (2008) believe that the arrival of "digital natives" in the classroom is being treated as an academic form of a "moral panic," but find little evidence that "traditional education" is unprepared for the "sophisticated technical skills and learning preferences" that these students bring. Results from a variety of surveys cited by the authors indicate that "digital natives" show high levels of ownership of technology devices such as computers and mobile phones, and they demonstrate high levels of academic and recreational activities such as word processing, emailing, and surfing the Internet for pleasure. However, only 21% of the students were engaged in higher-level skills such as content creation and multimedia creation for the Internet. The assumption that digital natives "think and process information fundamentally differently" from students of the past is also unconfirmed by Bennett, Maton, and Kervin. For example, while digital natives are known to engage in multitasking, these authors assert that multitasking is not a new phenomenon and that there is no evidence that multitasking

applies to student preferences outside of recreational activities such as playing games and surfing the Internet.

Other than students expressing frustration regarding school Internet restrictions and mentioning differences between the ways the Internet is used in and out of school, Bennett, Maton, and Kervin (2008) found no reason to conclude that digital natives were suffering from a "widespread and profound disengagement in learning." Further, several studies (Sutherland-Smith, 2002; Eagleton, Guinee and Langlais, 2003; Lorenzo and Dziuban, 2006) indicate that students are not as Internet-savvy as might be assumed, citing student frustration when search results do not provide instant gratification, shallow and random online text interactions, and lack of critical thinking when using Internet-based resources.

Helsper and Eynon (2010) made comparisons between "digital immigrant" teachers and "digital native" students through the lens of teaching and learning to study the gap between digital immigrants and natives proposed by Prensky (2001a, 2001b). The researchers concluded that "adults, specifically teachers, can 'speak the same language' as their students if they want to" (p. 516). Further, Helsper and Eynon believe that while understanding the technology used by students is important, there is not necessarily a cause to change pedagogy and curriculum.

In an interview with author John Palfrey, Harris (2009) reports that,

> ...the gulf actually isn't so wide...between the most native of digital natives and the most troubled of digital immigrants. What joins these communities are the same old values that have always joined us, and the

fact that we use technology differently or relate to information or one another differently doesn't mean that we can't have a conversation. (p. 32)

Guo, Dobson, and Petrina (2008) conducted various technology skill assessments and found no statistically significant differences between the technology skills of "digital natives" and "digital immigrants." They speculate that social and psychological barriers may exist for so-called digital immigrants in learning behaviors that appear on the surface to be differences between digital natives and digital immigrants. They state that, "further research is needed to examine the barriers for teachers, regardless of age, of effective use of emerging technologies in classroom settings, and how to remove those barriers" (p. 252).

The description of technology use in the home of school-age children reveals a dichotomy of family sentiments regarding technology. On one hand, many parents subscribe to Alters and Clark's (2007) "lay theory of media effects" and believe that new media "cause children to become antisocial, violent, unproductive, and desensitized to influences such as commercialization, sex, and violence" (in Ito et al., 2009, p. 150). Further, Horst (in Ito et al., 2009, p. 192) reports that children believe that conflict results when parents attempt to set boundaries and rules regarding technology use in the home. Some children feel that their parents are "clueless or incompetent in dealing with the norms and literacies of online peer culture" (p. 192).

On the other hand, Horst (in Ito et al., 2009) describes how families use technology and media as a way to facilitate family bonding. Examples of family bonding through technology use include playing video games (particularly among fathers and sons); creating media projects together such as websites or videos with different family

members taking on different roles of production; and in some families, the school-age child acts as the "information broker" in using technology tools. In a study of "gamer parents," Ito and Bittanti (in Ito et al., 2009) report that 80% of computer-game-playing parents play computer games with their children and that 66% of those parents believe it brings their family closer together (p. 207).

Although the researchers described here found no indication of major differences between so-called "digital natives" and "digital immigrants," clear evidence is reported that students and teachers are using technology as part of their daily lives, especially as information consumers and for recreation. The authors acknowledge that our world is growing increasingly digital and that the use of devices and services is occurring in the educational realms of curriculum design, classroom instruction, and education research.

Curriculum, Instruction, and Research

Research and writing in the area of "twenty-first century skills" frequently includes issues related to technology use and integration, but is by no means limited to the area of technology (International Society for Technology in Education, 1998, 2007; Partnership for 21st Century Skills, 2011; Wagner, 2008a). In some cases, authors question "traditional" skills and instruction and then advocate their own lists of skills that they believe students will need to be successful in the twenty-first century (Perkins, 2008; Wagner, 2008a; Walser, 2011). In addition, some researchers compare students' out-of-school informal learning pursuits with more formal in-school learning (Hsi, 2007; Quintero in Duckworth, 2001), comparisons that often involve the discussion of technology use. Finally, some researchers' methods can serve to inform the area of

technology integration research in general (Duckworth, 2001; Hsi, 2007; Rothman in Walser, 2011).

Quintero (in Duckworth, 2001, p. 94), following Duckworth's educational strategies and philosophical beliefs, poses several questions about school experiences that concern technology integration and other twenty-first century skills. Quintero states that children seem more interested in "nonacademic activities" than those they are learning in school. Her questioning of traditional curriculum includes:

- What underlies this division between formal and non-formal learning?
- Is this separation the result of lack of connection between school life and everyday experience?
- Why does the school fail to engage these children in formal learning activities?
- Are there some formal activities that engage them? Which? How? Why?

This questioning is representative of many authors who write about twenty-first century skills and in many cases, out-of-school student technology use is one consideration that bridges the perceived gap between informal and formal educational experiences (Blowers, 2010; Gee, 2008; Hsi, 2007; Prensky, 2006; Project Tomorrow, 2011; Shaffer, 2007).

Ito et al. (2009) acknowledge that the nature of traditional ideas regarding literacy is being challenged in the Digital Age. They encourage educators to closely examine how students are engaging in new media before attempting to create school curriculum to teach new forms of media literacy, stating,

> Unlike academic knowledge, whose relevance is often limited to classroom instruction and assessment, new media literacy is structured by the day-to-day practices of youth participation and status in diverse networked publics. This diversity in youth values means that kids will not fall in line behind a single set of literacy standards that we might come up with, even if those standards are based on the observations of their own practices. (p. 334)

Perkins (2008) offers an extended metaphor for teaching and learning in the twenty-first century that he describes as "learning by wholes." In his metaphor, Perkins equates teaching and learning to playing baseball. His seven steps (Perkins, 2008, pp. 8–15) are paraphrased here:

1. "Play the Whole Game"—find a complete "junior version" of the curricular idea in the lesson design stage to allow students to experience the learning activity in its entirety.
2. "Make the Game Worth Playing"—answer the learners' question, "Why are we studying this?" at the beginning of the learning experience.
3. "Work on the Hard Parts"—identify difficulties, practice, develop strategies, and reintegrate the new learning back into the process.
4. "Play Out of Town"—learn in different physical and geographical settings to deal with issues of transfer.
5. "Uncover the Hidden Game"—find the "layers" beneath the obvious surface issues of curricular activities.

6. “Learn from the Team...and Other Teams”—allow students to work and learn collaboratively.
7. “Learn the Game of Learning”—focus on time, place, ideas, skills, prior knowledge, and other learning strategies to allow students to learn about their own learning.

Perkins (2008) also cautions against a common issue when integrating technology into a learning experience. He states that, “...any learning activity has secondary dimensions that require or invite attention. A certain amount of that can be enriching, but it sometimes happens that the secondary dimensions end up gobbling much of the learning time” (p. 47). These “secondary dimensions” might include such activities as using unfamiliar or overly complicated software, unfocused Internet research, or other poorly planned uses of technology tools. Finally, Perkins advocates for schools to “use technology-based learning environments to attempt learning by wholes” (p. 226). Perkins does not elaborate on specific attributes or tools in his recommendation to create and use “technology-based learning environments.”

Kennedy et al. (2008) observed first-year college students and found the students to have particularly high skills and frequency of use in entertainment and peer-communication areas such as instant messaging, texting, social networking, using RSS feeds, and downloading MP3s; however, while students indicated that some of these activities might have uses in school, neither the students nor the authors of this research indicated in what ways these technologies might be used effectively.

Hsi (2007) promotes cooperative inquiry research methods when working with students:

> The advantages of engaging children as data collectors and curators of their own artefacts, knowledge, and insights is that data can be more easily collected in everyday settings, and carry the intentionality, authenticity, and perspective of the digital kids themselves. (p. 1520)

Hsi acknowledges that currently, few studies exist that link the informal, out-of-school, interest-driven student learning to the more formal learning that occurs in school. Hsi believes that the daily activities of students can be used as a framework to define "digital fluency." Hsi cites several attributes that should be considered when studying digital fluency. She believes that "digital kids:"

- Build upon their own skills and knowledge, as well as those of their peers, to learn from their experiences and create new ones.
- Create different and multiple identities and roles in online environments.
- Use their technology-based skills voluntarily and over time to learn and pursue topics of their own interest.
- Construct their own social realities and establish their own norms as they participate in online communities.
- Engage in self-expression to create their own online media and consume online media created by others.
- Multitask using devices and multiple media types.
- Work to solve complex problems that require distributed teams to solve, especially in the context of online video games.

Rothman (in Walser, 2011) believes that traditional assessments do not adequately measure twenty-first century skills and instead advocates computer game-

based assessments. He believes that a successful assessment design should provide realistic, but not too familiar subject matter so the assessment will provide a "level playing field" for students. Challenges inherent in computer game-based assessment design are the management and selection of metrics and the assurance that assessments are accurate. Rothman shares some examples of theoretical research, but provides no examples of current use of academic computer game-based assessments.

The teaching and learning research methods of Duckworth (2001) offer a questioning framework for research based upon traditional progressive education ideas. Above all, Duckworth advocates that teachers, "Listen. Have learners tell us their thoughts" (p. 181). She presents a set of research design strategies:

> Know the subject matter well. Tune in when subject matter surprises us. Watch for phrasing of any technical term in nontechnical language. Watch for times when subject matter is encountered unexpectedly. Offer materials, questions, activities, and comments to engage subject matter. Honor what learners already know (or surprise them with what they thought they knew). (p. 182)

These strategies are presented in the context of both lesson design and instructional research.

Further, Duckworth (2001) offers a statement well suited for curriculum design in the Digital Age: "If fields of knowledge are to be accessible to learners, they must be presented in all their complexity. When we oversimplify curriculum, we eliminate the very specifics with which learners can connect" (p. 186). This sentiment, along with Duckworth's methods for questioning, Perkins's (2008) idea of "learning by wholes,"

Hsi's (2007) acknowledgement of following student interest toward "digital fluency," and a need to explore alternate assessment methods (Rothman, in Walser, 2011), suggests a path for educators to more closely examine areas of student interest and activity outside of school to make in-school learning experiences more engaging and more relevant in the twenty-first century. This exploration requires attention to the issues of innovation, creativity, and the ways learning environments are structured and facilitated.

Innovation, Creativity, and Learning Environments

As educators integrate more technology into learning environments, issues begin to arise regarding methods used by teachers, philosophies behind teaching and learning, responsible uses of technology, student interest and engagement, content and pedagogical approaches, and other issues inherent to teaching and learning. Innovation and creativity are frequently cited among the characteristics that students need in the twenty-first century (International Society for Technology in Education, 2007; Ito et al., 2009; Johnson, Smith, Smythe, & Varon, 2009; Partnership for 21st Century Skills, 2011; Pink, 2005; Wagner, 2008a; Walser, 2011). Further, a few researchers discuss the nature and context of learning environments of the twenty-first century by looking to students to learn about the current realities of technology use (Blowers, 2010; Dessoff, 2010; Gee & Levine, 2009; Ito et al., 2009; Ohler, 2010).

Ohler (2010) poses the fundamental argument that education leaders have a choice: allow students to live a relatively non-digital life while at school because technology is "too expensive, problematic, or distracting to integrate into teaching and learning" while they live a digitally saturated life at home; or, allow students to use technology in a blended and meaningful way while in school. Ohler advocates that

educators help our "digital kids" find a balance between personal empowerment and community responsibility by teaching students the wise and responsible uses of technology in the school environment.

Dessoff (2010) reports on a variety of school and district-level initiatives across the United States that focus primarily on updating the skills and pedagogy of teachers and principals because students are coming to school with familiarity with digital devices and technology tools that they use outside of school. He believes that educators should build upon student interests stating, "With ready access to computers and a wide range of mobile devices, many students already are familiar with available technology tools and use them all the time..." (p. 40).

Blowers (2010) believes that schools should support the engagement, enrichment, and empowerment of students by designing strategies that are based upon core values of the students supported by the systems, rather than to merely support the advancement of technology in general. She believes that engagement involves social influence of students to connect and share their expertise, opinions, and talents; enrichment provides online experiences that enhance real-world daily life; and empowerment involves a students' ability to personalize and control the "digital reality" experiences of identity, privacy, creativity, sharing, and advocacy.

Gee and Levine (2009) cite evidence that students demonstrate engagement in such entertainment activities as playing complex video games and producing media collaboratively. Despite the fact that students are engaged in certain activities, they believe that schools are facing a growing "student engagement crisis," citing urban dropout rates of 50% and surveys that indicate that students are bored in school. Gee and

Levine believe that some of the solutions to this crisis of engagement may come from bringing simulation, reality-based, and commercial games into the classroom. Further, they believe that teachers must be tech savvy by using and producing media with technology tools such as YouTube, blogs, and social networks. The researchers do not advocate expertise, but rather stepping into the digital worlds of students and not worrying about failure, for the purpose of knowing what their students are doing online. Unfortunately, like other computer game advocates (Gee, 2008; Prensky, 2001b, 2006; Shaffer, 2007), these researchers have few concrete examples or success stories that have been tested widely by teachers since so few high-quality computer games have been designed and developed with curricular uses at their core.

Prensky (2010) advocates for school reform by changing both the content of what schools teach and also the pedagogical approach of how schools teach. Specifically, Prensky advocates for teachers to connect with their students to learn more about interests and passions and then serve as partners, as opposed to teaching by "telling." Prensky states, "this better pedagogy is already being used successfully, under a variety of names (such as 'active,' 'student-centered,' 'inquiry-based,' and 'challenge-based' learning), in many of our classrooms" (p. 7).

Lange and Ito (in Ito et al., 2009) cite work by Buckingham that acknowledges that educators today are in a transitional period regarding the nature of how students view and consume media. Lange and Ito contend that, "consumption is not passive; viewers and readers shape cultural meaning from consuming media" (p. 246). Buckingham believes that the old method of teaching students about media creation and media issues is changing to a format where students serve as the "media producer developing voice,

creativity, agency, and new literacy" (p. 248). Lange and Ito also describe that students learn to use new media by being inspired by a work or another creator they found online (p. 262). Many students report that they are "self taught" through a combination of "playing around with" software or equipment, receiving direction from peers, participating in school projects, and finding online support when they need it.

Another transition that has occurred in the literature surrounding technology integration in schools is the manner in which the teaching of technology skills is currently advocated. The International Society for Technology in Education presented the first draft of the National Educational Technology Standards for Students (NETS-S) in 1998. These technology foundation standards for students were presented in six categories. The first standard was "Basic Operations and Concepts" and stated, "students demonstrate a sound understanding of the nature and operation of technology systems" and "students are proficient in the use of technology" (International Society for Technology in Education, 1998). However, the 2007 revised version of NETS-S re-ordered this standard by moving "Technology Operations and Concepts" to the final list position; the new first standard became "Creativity and Innovation" (International Society for Technology in Education, 2007). The complete 2007 NETS-S standards include: Creativity and Innovation; Communication and Collaboration; Research and Information Fluency; Critical Thinking, Problem Solving, and Decision Making; and Technology Operations and Concepts (International Society for Technology in Education, 2007). In a discussion of the history of NETS-S, Schrum and Levin (2009) report that the "original technology standards were focused on tools, technology tasks, and ethical behavior... The newest

student technology standards are focused on 21st-century skills, Web 2.0 characteristics, and collaboration" (p. 14).

Finally, Lange and Ito (in Ito et al., 2009) report that they have observed a group of children with high-interest in new media who wish become media professionals. These students follow a self-directed and independent pattern of learning new media by engaging in their own training, improving their technical skills, using the web to gain visibility and reputation, developing their own relevant contacts, and receiving material and emotional support from their families to pursue their personal learning. Lange and Ito conclude that, "When youth have the opportunity to pursue projects based on their own interests, and to share them within a network of peers with similar investments, the result is highly active forms of learning" (p. 291).

The discussion of technology's use in the context of Innovation, Creativity, and Learning Environments is both practical and philosophical. Although technology use is already pervasive, incorporating technology with no pedagogical plan or curricular design may not necessarily improve teaching or learning. Further, student use of technology is manifesting issues of social and cognitive development.

Student Social and Cognitive Development

Several researchers assert that technology use among students, age preschool through high school, has an impact on various developmental areas. Researchers who discuss issues of cognitive development include Zevenbergen and Logan (2008); Prensky (2001b); and Helsper and Eynon (2010). Horst, Herr-Stephenson, and Robinson (in Ito, et al., 2009) address the physical development of students. Various issues of social development in the context of student technology use are discussed by boyd (in Ito et al.,

2009), Lusk (2010), Gee (in Walser, 2011, pp. 48–54), and Ito and Bittanti (in Ito et al., 2009). Finally, Medina (2008) cites Mayer's principles regarding how multimedia affects learning.

Zevenbergen and Logan (2008) acknowledge that literature in technology in education focused primarily on "older children and young adults" so they "sought to explore the ways preschool children may be engaging with digital media in the home and how this may impact on early childhood pedagogy." They believe that young children are more connected with the availability of communications devices, that communication is more global than in the past, and that technology has created a culture of immediacy in terms of everyday experiences. Zevenbergen and Logan also believe that the wide availability of multiple technology resources has created a disposition of multitasking in children of all ages.

Prensky (2001b) discusses both "neuroplasticity," the neurobiological idea that the brain is constantly reorganized, and "malleability," a tenet of social psychology that people from different cultures have different thought processes, and concludes that "today's neurobiologists and social psychologists agree that brains can and do change with new input" (p. 6). Prensky goes on to advocate for computer game-based learning as one possible solution to address the brain development issues he poses. He believes that the brains of teenagers at the computer are "almost certainly physiologically different" and that, "We now have a new generation with a very different blend of cognitive skills than its predecessors" (p. 4).

Nine years later, Helsper and Eynon (2010) acknowledge that while students use technology throughout their daily lives, they found no indication that fundamental cognitive development is affected by the use of technology:

> A larger proportion of young people use the Internet, they are more likely to come from media-rich homes, are more confident about their skills and are more likely to engage in online learning activities. What implications this has for young people's brain structures remains an open question. (p. 515)

Horst, Herr-Stephenson, and Robinson (in Ito, et al., 2009) report that, contrary to popular belief, technology use does not contribute to isolation or a sedentary lifestyle among today's youth. In fact, students who engage in using high amounts of media report more family time, hobbies, and physical activity than their peers who report using less media (Roberts, Foehr, & Rideout, 2005).

In a discussion of online social media sites, boyd (in Ito et al., 2009, p. 84) reports that most teens who use social media do not view their online lives as "alternative" or "virtual" worlds, but rather as additional methods to connect with their peers in their "regular" lives (Abbot, 1998; Osgerby, 2004). Further, teenagers use social media on a variety of platforms, services, and devices including social networking sites, instant messaging, and mobile phones. Teens use social media to build, maintain, and develop friendships and also to help them share ideas, display artifacts such as photos and videos, and convey their emotions (Ito et al., 2009, p. 113).

Lusk (2010) cites four primary dangers of youth using social networking sites: receiving bad advice from ill-informed sources (especially about health), being

encouraged to take part in negative or harmful behavior, cyberbullying, and providing too much personal information in their personal online profiles and when commenting on the profiles of friends. Lusk (2010) lists ways that parents and educators may help guide students in online activities: teach methods to appropriately search the Internet for accurate information, foster respectful and appropriate relationships on social networking sites, and maintain a respectable and protected online persona. Beyond interacting with peers, Lusk reports that students may also use online tools for creative self expression, problem solving, dealing with conflict, and understanding how to use technology to communicate.

Gee (in Walser, 2011, pp. 48–54) reports that game designers recognize that learning and identity are interrelated by allowing players to produce their own game environments and create their own online identities. Further, the games themselves allow problems to be solved in multiple ways. Well-designed and complex games introduce problems and tactics early and present opportunities for practice in a "mastery phases" so later in the game, a larger challenge can be presented that, when completed, will allow the player to move to the next level.

The study of social-development-based new media literacies is gaining prominence by researchers. In addition to social-emotional issues that have been traditionally been taught in the home and reaffirmed at school through social-emotional education programs (Collaborative for Academic, Social, and Emotional Learning, 2003), online social norms are another area that students need to learn to navigate. According to boyd (in Ito et. al, 2009),

> Youth are developing new norms and social competencies that are specifically keyed to networked publics, such as how to articulate friendships, how to be polite to their peers, and how to create, mediate, or avoid drama. For youth who hope to succeed socially in their school-based peer networks, these kinds of new media literacies are becoming crucial to their participation. Given the prominence of social media in both contemporary teen and adult life, learning how to manage the unique affordances of networked sociality can help teens navigate future collegiate and professional spheres where mediated interactions are assumed. (p. 113)

Much has been written on the topic of how computer games might contribute to student learning if educational games are developed and implemented following certain theories and guidelines (Gee, 2008; Prensky, 2006; Shaffer, 2007). Ito and Bittanti (in Ito et al., 2009) believe that computer games played recreationally by school-age children contribute to both social and technical learning: "Another important dimension of recreational gaming is that the social relationship and knowledge networks that kids develop often become a pathway to other forms of technical and media-related learning" (p. 213). Ito and Bittanti do not necessarily advocate that computer games should be brought into school, but they acknowledge that social and technical learning is occurring through game play.

During his extended discussion regarding sensory integration, Medina (2008) cites cognitive psychologist Richard Mayer's five principles for how multimedia positively affects learning:

Multimedia—display words along with pictures.

Temporal contiguity—present words at the same time as a related picture.

Spatial contiguity—corresponding words and pictures are presented in proximity to each other on a page or screen.

Coherence—unrelated material is excluded.

Modality—animation and narration is better than animation and on-screen text.

Medina links his ideas to education environments by reporting that, "groups in the multisensory environments always do better than the groups in the unisensory environments. They have more accurate recall. Their recall has better resolution and lasts longer, evident even 20 years later." (p. 208).

Because technology is integrated into the everyday lives of students and because many students use technology as a means to communicate and connect with friends, it is not surprising that technology use is affecting the social and cognitive development of today's children. However, few researchers are connecting this outside-school experience to the possible teaching and learning ramifications these developmental effects may or may not have on students. The following student technology use statistics relate to the cognitive and social development issues discussed above.

Student Technology Use Statistics

Reports that focus on technology use among school-age children are used by both academic researchers and the popular media to indicate that technology use among children is both prevalent and increasing (Project Tomorrow, 2011; Rideout, Foehr, & Roberts, 2010; Zevenbergen & Logan, 2008). Over the years, trend data has shown that some technologies have reached the level of ubiquity (Rideout, Foehr, & Roberts, 2010).

Three studies present statistics regarding technology use among school-age children, including, “Generation M2: Media in the Lives of 8- to 18-Year-Olds” (Rideout, Foehr, & Roberts, 2010), “Computer Use by Preschool Children: Rethinking Practice as Digital Natives Come to Preschool” (Zevenbergen & Logan, 2008), and “The New 3 E’s of Education: Enabled, Engaged, Empowered: How Today’s Students are Leveraging Emerging Technologies for Learning” (Project Tomorrow, 2011).

Since 1999, the Kaiser Family Foundation has administered large-scale studies about media use among children age 8–18. A report from 2011 is based upon data collected from 2,002 school-age students between October 2008 and May 2009. “Multitasking” data was also collected from a subset of these students. The study reports student use of media including TV, computers, video games, music, print, mobile phones, and movies (Rideout, Foehr, & Roberts, 2010).

It is important to note that the study by Rideout, Foehr, and Roberts (2010) specifically includes only recreational media use, not media use related to school or homework. However, the study quantifies media multitasking and accounts for the time students spent using media recreationally while students were also working on homework or other projects outside of school. The study also provides an extensive methodology section that describes each media use and calculation in detail. Media, as defined in this study, includes computer, movies, music, print, TV content, and video games (pp. 5–6). Finally, because the findings of Rideout, Foehr, and Roberts (2010) are most frequently combined into a single group of 8–18-year-olds, the conclusions may not precisely represent the 8–14-year-olds who are the focus of this study.

Rideout, Foehr, and Roberts (2010) report that media ownership among children age 8–18 includes equipment used in the home, equipment children report to have in their bedrooms, and media services used in the home. Among students in the study, 99% report to have at least one TV, 93% report to have at least one computer, and 87% report to have at least one video game console. The same children were asked about the media they have in their bedroom and children reported that 71% have a TV, 36% have a computer, 33% have Internet access, and 50% have a video game console. Finally, 84% of students age 8–18 reported that they have home Internet access and 59% of Internet access was high-speed or wireless.

Personal media ownership among children is shown to increase as children get older, according to Rideout, Foehr, and Roberts (2010). Among children age 8–10, 61% own a personal iPod or other MP3 player, 31% own a mobile phone, 65% own a handheld video game player (i.e., Nintendo DS, Sony PSP), and 17% own a laptop. Among children age 11–14, 80% own a personal iPod or other MP3 player, 69% own a mobile phone, 69% own a handheld video game player, and 27% own a laptop.

Rideout, Foehr, and Roberts (2010) also report the amount of time children spend using media, including multitasking behavior, to show the percentage of time children are using two or more media types simultaneously. On a typical day, children age 8–18 spend 4 hours, 29 minutes watching TV content; 2 hours, 31 minutes listening to music and other audio; 1 hour, 29 minutes using the computer; 1 hour, 13 minutes playing video games; 38 minutes reading print media; and 25 minutes watching movies. The total average time using media per day is 7 hours, 38 minutes, but these children are exposed to 10 hours, 45 minutes of media per day when considering time spent multitasking; thus,

29% of media exposure is simultaneous. Interestingly, children age 11–14 report even higher media use per day (11 hours, 53 minutes) than their high-school-age peers (11 hours, 23 minutes), while children age 8–10 have the lowest media exposure per day (7 hours, 51 minutes).

Rideout, Foehr, and Roberts (2010) asked students about the "media rules" in their home. The majority of children in this study report at least some media use rules imposed by their parents in one or more categories. Perhaps not surprisingly, as children become older, they report having fewer media use rules. Children age 8–10 report the following: 64% have rules about "What they're allowed to do on the computer;" 66% have rules about "What they're allowed to watch on TV;" 54% have rules about "Which video games they're allowed to play;" 47% have rules about "What music they're allowed to listen to;" and only 3% report that they have "No rules" regarding media use. Children age 11–14 report the following: 60% have rules about "What they're allowed to do on the computer;" 51% have rules about "What they're allowed to watch on TV;" 33% have rules about "Which video games they're allowed to play;" 27% have rules about "What music they're allowed to listen to;" and 11% report that they have "No rules" regarding media use.

Zevenbergen and Logan (2008) found that 87% of preschool students age 4–5 have regular access to computers at home. These preschool students primarily spent time playing educational games (80%), non-educational games (60%), and drawing on the computer (49%), while 40% of these students used the Internet. The authors suggest that "preschool children have developed a high number of skills through their interactions with the computer," including that 80% of preschool children can use a mouse, 47% can

find letters and/or numerals [on a keyboard]; 42% can type letters [on a keyboard]; 37% can load a CD/DVD [into a computer]; 30% can use drawing tools; 26% can turn a computer off and on; 19% can use a touch pad; 17% can print [to a printer]; 17% can type words; 14% can use the tool bar [as part of computer software]; 12% can use pull-down menus; 8% can retrieve files [on the computer]; and 5% can save files [on the computer].

In 2010, the national education nonprofit group Project Tomorrow (2011) surveyed 294,399 K–12 students about general technology use and ownership. Respondents were asked targeted questions about school uses of technology and answered questions about their ideas for an "ultimate school." The report poses the question, "Are our schools effectively tapping into all of the potential of these emerging technologies to create this kind of new learning experience for our students?"

Among Project Tomorrow (2011) respondents in Grade 6, 73% have an MP3 player, 50% have a cell phone, and 25% use electronic books. Almost 50% of girls and over 33% of boys report that they maintain a profile and regularly update a social networking site, even though the terms of the social networking sites state that the students are not old enough to have an account (Project Tomorrow, 2011).

Students in Grades 3–8 report a high level of access to various mobile devices with students in Grades 6–8 having more access in all categories of mobile devices. Among students in Grades 3–5, 29% have a cell phone without Internet access, 19% have a smartphone, 42% have a laptop, 55% have an MP3 player, and 8% have a tablet device. Among students in Grades 6–8, 51% have a cell phone without Internet access, 34% have a smartphone, 60% have a laptop, 79% have an MP3 player, and 13% have a tablet device (Project Tomorrow, 2011).

Project Tomorrow (2011) asked high school students how they would use mobile devices at school if they were permitted to do so. Students younger than high school were not asked this same question, even though high percentages of pre-high-school students reported that they have mobile devices. The high school students responded that 74% would check grades, 59% would take notes in class, 50% would use calendar features, 44% would access online textbooks, 44% would send email, and 40% would use their mobile devices to learn about school activities.

A majority of parents of students in Grades K–8 surveyed by Project Tomorrow (2011) reported that they would not only purchase mobile devices for their children to use in school, but they would also purchase data plans for the devices. 63% of parents of students in Grades K–5 and 69% of parents of students Grades 6–8 reported that they are "likely to buy a mobile device for their child to use at school" (p. 7). 51% of parents of students in Grades K–5 and 57% of parents of students in Grades 6–8 said they are "also likely to purchase a data plan for that mobile device" (p. 7). Similarly, 52% of parents consider instructional technology to be extremely important for their child's success (p. 13). When students in Grades 6–8 were asked about mobile learning in their "ultimate school," students responded that they would like to use the following devices: laptop (51%), smartphone (49%), iPad (43%), and 62% wanted to bring their own devices to school.

Additional statistics regarding school technology preferences and twenty-first century skills were reported by Project Tomorrow (2011). Among students in Grades 6–8, 19% reported taking classes online. 51% of students in Grades 6–8 said that working with other students on projects is the best way for them to learn science. 48% of students

in Grades 3–5 and 53% of students in Grades 6–8 view digital textbooks as essential in their "ultimate school." The top complaint of middle school students was that school filters block the websites they need to complete their schoolwork.

Both the Kaiser Family Foundation and Project Tomorrow (along with previous NetDay studies) provide trend data that describes an increase in all areas of new media use among school-age children since 1999 (Kaiser Family Foundation, 2010; Project Tomorrow, 2011). The information reported here was selected because these topics are discussed later in this study as having possible in-school teaching and learning implications among students age 8–14.

Review of Literature Conclusions

Each of the five categories identified in this review of literature contribute to a more general understanding of student technology use outside of school and suggest possible ways to consider technology integration in school. The section Our Increasingly Digital World acknowledges that teachers and students are using technology at various levels of interest and skill, but that in-school and out-of-school technology use is disconnected. The Curriculum, Instruction, and Assessment section clearly establishes technology use as a tenet of twenty-first century life and learning. Similarly, the Innovation, Creativity, and Learning Environments section offers technology as one method to deliver twenty-first century skills. The section regarding Student Social and Cognitive Development offers examples of how technology affects student development across all age levels, preschool through high school. Finally, Student Technology Use Statistics presents clear indications that student technology use is both pervasive and on the rise among students.

Although this literature review located writing and research that relates to student technology uses both in and out of school, I was unable to find researchers or authors who explore how students in Grades 3–8 bridge out-of-school technology use to teaching and learning in school as a primary research focus. Researchers have discussed both positive and negative examples of student technology use in schools; however, few concrete recommendations are reported about what technology might or might not work, even in specific situations. Similarly, authors who cite increased student use of technology sometimes imply that schools should be using more technology just because students are using more technology outside of school. These recommendations do not include why using more (or less) technology might improve teaching and learning. Regarding the literature about social and cognitive technology use, students appear to be left mostly on their own to figure out online social and emotional issues for themselves. Finally, the types of technology use statistics reported often require the reader draw implicit conclusions about what might be useful or effective in schools, or the reports include a few cursory ideas about how to integrate technology in school. Considering these conclusions and the volume of information related to student technology use outside of school, it seems clear that further research in this area will serve the education community on the topic of relating out-of-school student technology uses to teaching and learning in the classroom.

SECTION THREE: METHODOLOGY

Research Design Overview

This study is framed as an ethnographic exploration of student technology use in the qualitative tradition (Patton, 2008). The study focuses on students in Grades 3–8, a population that is represented by data regarding technology use statistics, but lacks information regarding how students are using technology from the students' point of view. The research design decision to collect data from student focus groups was purposeful so data could be collected in the student voice.

Participants

The participants of this study include students in Grades 3–8 who attend the five schools in The Winnetka Public Schools, District 36, in Winnetka, Illinois, a high-performing elementary school district located in an affluent Chicago suburb. The stakeholders include the students and other members of a learning community including teachers, administrators, and parents, since all were either directly or indirectly affected by the outcomes of this study. The community-at-large and the global education community also serve as an audience for this information since some of the implications of this study can be generalized.

Students, teachers, administrators, and parents are the primary stakeholders because the research findings lead to the application of different methods of instruction in the classroom. Beyond the potential educational implications, parents and school staff may be interested to learn about the technology integration experienced by their own children and their children's peers from this education-focused perspective.

Teachers of The Winnetka Public Schools were asked to recommend student participants for focus groups. In the elementary schools, each classroom teacher was asked to recommend two boys and two girls from each classroom. In the intermediate and middle schools, each homeroom teacher or advisor was asked to recommend two boys and two girls in each class. Teachers were asked to make recommendations based upon their perspectives of students perceived to represent technology use among their peers or who had a specific demonstrated interest in technology. Teacher recommendations were shared with building principals and the principals were also asked for additional recommendations. At one school, students were asked to volunteer for focus groups. From the teacher and principal recommendations and the list of possible student volunteers, students were selected at random to fit the demographic criteria described below. Parents of potential focus group participants were contacted to make a decision about participating in this study. With consent from the parents, the focus groups were conducted at each school in groups of up to five participants. The focus group interview meetings were planned to last no more than 45 minutes each. The total sample was planned to number 50–70 students, evenly distributed across grade level groups and genders. This focus group sample represents between 3.88% and 5.43% per grade level in Grades 3–8 in District 36 (N = 1,288).

Data Gathering Techniques

The types of data gathered include qualitative descriptions, anecdotal evidence, and examples from student focus groups of up to five students conducted in the school setting.

The focus groups were planned to represent students in each of the grade levels. Grade 3 and 4 focus groups were held at the three elementary schools in District 36: Crow Island School, Greeley School, and Hubbard Woods School. Grade 5 and 6 focus groups were held at The Skokie School. Grade 7 and 8 focus groups were held at Carleton Washburne School. Grade 3 was selected as the starting grade level because researchers from the literature review cite age 8 as the age when children begin to make independent choices about their technology preferences and demonstrate independence in using Internet-delivered services (Robinson & Horst in Ito et al., 2009, p. 204). Further, the majority of available survey data regarding the uses of technology among school-age children begins at age 8 (Rideout, Foehr, & Roberts, 2010; NetDay, 2004, 2005; Project Tomorrow-NetDay, 2005; Project Tomorrow, 2006, 2007, 2008, 2011).

The focus group topics sought information regarding the ways students choose to spend time using technology; the websites, social networks, and network-delivered services students report using; the types of gadgets and devices students use for entertainment and learning; and the ways students use technology to communicate among their peers, friends, and families. An interview protocol was created from technology use information learned in the review of literature. Follow-up questions were based on participant responses. Further, follow-up questions and other opportunities were given for participants to volunteer their own uses, issues, and concerns regarding technology that were not prompted by questions. The goal was to allow students to provide information about their uses of technology in their own voices following the students' own structures and interests as raised during the focus groups.

The data was captured and assembled using audio and video recording of the focus group conversations, preparing transcripts of the conversations, and then coding the responses for patterns using *Excel* spreadsheets. Digital photos and on-screen examples were also used to document some of the focus group sessions and to help illuminate the topics discussed by the students.

Data Analysis Techniques

Coding methods were adapted from Saldaña (2009) to analyze the qualitative data from the focus groups. The interviews were transcribed and the transcriptions were coded in multiple cycles. Cycle one included the tier one coding method of attribute coding to capture basic participant information. The tier one structural coding method was used to reveal patterns from the content of responses following the interview questions, while the tier two holistic coding method established the basic themes and issues raised by participants. Additional coding cycles focused on pattern coding to identify themes and constructs in the student technology use data.

The final presentation is written. In addition, photos, audio, video, and other digital media were collected for use in presentations of this study. Presentations were prepared and presented to appropriate audiences using the available data and artifacts. Although any research study presents privacy concerns among participants interviewed, the nature of this study presented some additional issues, including the possibility of learning information that some students, parents, and educators might deem sensitive. Every attempt was made to ensure the privacy and safety (both online and offline) of students and families involved in this study. When referring to students in focus groups, pseudonyms are used. When screen captures or other digital artifacts are used in

supporting presentations, potentially identifiable information such as names or screen names are blurred or otherwise removed from images. Further, photos used in presentations of this material do not include the faces of students or other identifiable information.

SECTION FOUR: FINDINGS & INTERPRETATION

Participant Selection and Focus Groups

For the purpose of selecting student participants in Grades 3–8, 81 District 36 teachers were invited to recommend four students each, two boys and two girls. The teachers invited were regular classroom teachers of students in Grades 3–4, homeroom teachers of students in Grades 5–6, and advisory teachers of students in Grades 7–8. The teachers were invited by sending one paper version of a survey via interoffice mail, one online version of the same survey via email, and two follow-up emails including links to the online survey. The survey window was one week, but surveys submitted up to two weeks later were accepted and considered.

In general, teacher survey response was low. A total of 12 of 81 teachers responded to the paper and online student recommendation survey (14.81%). One possible reason for the low response is that teachers could not identify students who use technology outside of school because they do not know this information. Another possible reason for low response is that several other surveys had been offered during the past year in this district and teachers could have been suffering from survey "burn out."

In addition to the teacher recommendations, all five District 36 principals and two assistant principals were asked to review the recommendations made by teachers in their buildings and also to volunteer additional recommendations. All principals and assistant principals generously volunteered their recommendations, time, assistance, access to students, access to staff, and meeting spaces for the purposes of selecting students, scheduling focus groups, and conducting focus groups.

At the Grade 7–8 building, the principal and assistant principal suggested and provided the opportunity for interested students in Grades 7 and 8 to volunteer for focus groups during one day's lunch periods. In three lunch periods, 35 students volunteered as potential focus group participants. At the Grade 5–6 building, two teaching teams provided several student recommendations in addition to the recommendation surveys. At the elementary schools, teacher and principal recommendations provided the focus group possibilities.

A total of 17 focus groups were conducted between December 13, 2011, and January 25, 2012. Fifty-five students participated representing five schools including Crow Island School, Greeley School, Hubbard Woods School, The Skokie School, and Carleton Washburne School in The Winnetka Public Schools, District 36. Of the 55 participants, an average of 9 (9.17) students per grade level participated (10 Grade 3 students, 10 Grade 4 students, 7 Grade 5 students, 12 Grade 6 students, 7 Grade 7 students, and 9 Grade 8 students). The focus group members totaled 4.28% of the total district population of students in Grades 3–8 (N = 1,284). Each grade level's population was represented by between 2.80% and 5.91% of the total population (5.29% of Grade 3 [n = 189], 4.41% of Grade 4 [n = 227], 3.48% of Grade 5 [n = 201], 5.91% of Grade 6 [n = 203], 2.80% of Grade 7 [n = 250], and 4.21% of Grade 8 [n = 214]). The focus groups consisted of one to five participants; most focus groups had three participants (3.24 average). The focus groups consisted of 25 girls (45%) and 30 boys (55%).

The total amount of focus group time was 6 hours, 41 minutes, 52 seconds. Focus group timings were compiled from audio and video recordings captured for transcriptions. The longest duration focus group lasted 41 minutes, 27 seconds, and had

five participants, while the shortest duration focus group lasted 9 minutes, 13 seconds, with one participant. The average focus group duration was 23 minutes, 38 seconds.

The complete transcription of all focus groups revealed that a total of 3,024 verbal exchanges were made among the researcher and participants. Excluding the researcher's comments and questions, participants contributed 1,962 verbal exchanges. Exchanges made by participants ranged from 1 word to 184 words. The average exchange by a participant was 9 (9.35) words.

Findings from these focus groups are grouped into eight primary categories, including Technology Device Access and Use, Gaming, Electronic Book Readers, Television and Online Video, Imposed Limits on Technology, Communicating Using Technology, and Technology in the School Environment. Other observations are also offered to discuss the additional patterns that emerged with less frequency than the main categories.

The eight categories were identified through the use of a multiple cycle, tiered coding process adapted from Saldaña (2009) that began by creating a verbatim transcription of researcher questions and participant responses from video and audio captured in each focus group meeting. For cycle one, tier one attribute coding, each of the 3,024 individual exchanges were coded by date, respondent, gender, grade, and school. All responses were sequenced and each was entered as a separate spreadsheet row so exchanges could more easily be sorted by attribute. Next, tier one structural coding was used to identify patterns such as products, services, activities, preferences, and dislikes expressed by participants. The basic themes emerged from keyword and topic analysis using the tier two holistic coding method. With the holistic themes established, additional

spreadsheets were created for further coding and analysis. Frequency analysis was used in situations when quantitative data is cited in this study.

Technology Device Access and Use

The participants observed in these focus groups come from households with a wide array of technology devices and services. Desktop and laptop computer access was so commonplace that most students spoke of this type of technology access as a typical part of everyday life. The discussion indicated that all participants had at least one desktop or laptop computer in their home. In cases where computer types were not specifically mentioned, the devices named implied that computers were present to support the devices that students discussed. For example, Grade 5 student Sean B reported using iTunes to download music and apps[3] for his iPhone, iPad, and iPod touch[4]; all three of these devices require a computer for initial setup and subsequent backups, indicating that there is likely at least one computer in that home. In all focus groups, a total of 71 desktop or laptop computers were discussed (1.29 computers per student). The participants indicated that they had equal access to laptop (28) and desktop computers (29). Fourteen of the computers discussed were not specifically identified as laptops or desktops. In general, this level of computer access is higher than the levels reported by students in surveys of children of similar ages (Project Tomorrow, 2011). This high level of access is likely attributed to the high socioeconomic status of this community.

About one-fifth of the participants (18.18%) indicated that they have access to a computer that they consider their own. Eight of the students who discussed their own computer have a laptop, while the other two have their own desktop. Olivia T, a Grade 8 girl, stated,

> I have a personal laptop that I bought for school work because I found it was so hard to manage all my work when I had to do it on my mom's computer...I do use my laptop for entertainment, watching videos on the websites like Hulu...My computer is also an active part in my school life. I use it for everything, dictionary, I use it for calculations, I use it for typing essays. It is a very important part of my life.

Handheld computing devices such as iPod touch and tablet computing devices such as iPad were discussed far more than laptop or desktop computers in these focus groups. Most students have access to multiple handheld or tablet computing devices with iPod touch, iPad, and iPhone devices being the most discussed. Devices including iPod touch, iPad, and iPhone all run the same operating system, run similar apps, and are also referred to as "iOS[5]" devices. Project Tomorrow (2011) indicates that between 8% and 13% of students in Grades 3–8 have access to tablet devices. These focus group participants report much higher tablet access than Project Tomorrow for two possible reasons. First, the iPad was released in 2010 (Apple, 2010b) and the Project Tomorrow statistics reflect data gathered from the previous year. Also, this affluent community indicates overall higher access to technology in general.

In these focus groups, 80 iOS devices were discussed as being available to participants (1.45 iOS devices per participant). These devices have Internet access, email access, messaging access, the ability to run apps, and are handheld gaming platforms. Over twice as many participants (44%) indicated that they own an iOS device, but do not own their own computer. David S stated, "Well, I have an iTouch so sometimes I game

on that. Like if I'm gaming, then I'll watch YouTube videos, go on the Internet, research something."

Although the iPhone is a phone, many participants, especially younger participants, report that they use family iPhones for running apps and gaming. In a discussion about games, Grade 3 student Maddie C indicated that she prefers to play games, "...on the iPhone, like *Doodle Jump* and *Angry Birds*." Grade 3 student Jeremy G (in a different group) said, "I occasionally use my mom or dad's iPhone if they let me, playing [*Temple Run* and football games]." Grade 6 student Amanda B reports that, "Both my parents and my sister have iPhones so I use some to play games."

The iPad was also frequently discussed as available in almost half of participant households (47.27%) and used for a variety of purposes. The iPad was often reported as a device shared among family members for various uses across all ages. "My family has an iPad and all of us use it. I use it a lot. I like sports so I play a lot of sports apps and games," reports Jeremy G, a Grade 3 student. Grade 6 student Becky E mentioned using the iPad as a video camera, "...my dad has one... He actually videotapes a little bit on his iPad in my hockey games." Zak M added, "I usually watch TV and play on my iPad." In the same group, Aidan M said that "I play games, but...I read a lot on my iPad." Emma C in Grade 3 says that, "I share the iPad with my 7-year-old brother," and in the next comment, Clara Y added, "I share the iPad with my whole family."

Gaming was a frequent topic among participants at all grade levels and many dedicated gaming systems were discussed. Gaming console systems, dedicated devices that connect to TVs that use specialized game controllers, were discussed the most. Participants discussed 74 gaming consoles (1.35 gaming consoles per participant). The

two most-discussed console systems were 29 Xbox systems (including Xbox LIVE and Kinect) and 28 Wii systems. Playstation was also mentioned by 13 participants as available in their homes. Handheld gaming systems were mentioned 26 times with the most popular identified as versions of Nintendo DS (DS, DSi, and DS light). In total, all participants indicated that 100 dedicated gaming systems were available to them.

Some students who identified themselves as "gamers," or had sibling or parent gamers in the family, mentioned owning five or more dedicated gaming systems. In one discussion, Nate Y, a Grade 8 boy, mentioned,

> I am actually considered a giant gamer. I am proud of it. I am an Xbox fan. I have been playing Xbox for years now...I have a Nintendo and a Wii...I have GameCube... And I have a PSP.

Tyler A, a Grade 3 boy, stated, "I play *Madden 12* and *LEGO Star Wars* on the Wii. And on the iPad... That's kinda all my games. But I used to have an old Xbox and I played basketball on it." Gina B, a Grade 4 girl, who is part of a family of gamers, said, "I have Xbox 360 and I have a Kinect. I have two Xbox 360s, one in my brother's room and one in my basement, and I have a Wii, but don't really use that 'cause I like Kinect."

Since the topic of gaming was so prevalent, it is significant to note that several devices are capable of playing games in addition to dedicated gaming console systems. (Similarly, some dedicated gaming console systems have features other than playing games.) Participants discussed playing games on computers, iOS devices, gaming console systems, and electronic book readers. In this study, the total of all potential gaming platforms discussed is 289, or an average of 5.25 potential gaming systems per participant. No participant mentioned having fewer than two potential gaming systems.

Travis T, a Grade 8 boy, discussed 17 total potential gaming systems available to him in his home:

> So I have a lot of gaming systems...Xbox 360, a Wii, iPods, iPod touches, two iPods, Nintendo 64 and games, Gameboy Advances. I have older brothers which is how I get all this stuff. Gameboy Color, we still play the Nintendo 64 even though the graphics might be horrible because they make the games so well...

The topic of reading electronic books on various electronic book readers was mentioned in several focus groups. Kindle electronic book readers were mentioned as available to participants a total of 13 times with one family owning three Kindle devices. Anna C, a Grade 4 girl, reported, "My family has three Kindles, like my brothers have their own, and my dad has one so we kinda like share them." In addition, iPad users also mentioned reading electronic books on iPad.

It is notable that participants were very aware of the many functions offered by their devices. Further, participants were aware of many of the features of the specific versions and models of devices that they own and use. Grade 5 student Dylan H watches video content on his gaming consoles, "I use Netflix on my PS3 and Xbox and I play games on Xbox." Nick A, a Grade 4 boy, prefers watching videos on a phone over a computer, "I don't play on the computer much. I usually go on my dad's phone and I watch videos." In a discussion about using the iPod touch, Grade 5 boy Dan M stated, "I play games on it—mainly sport games like *Madden* and stuff like that. Sometimes I text my dad with it using *iMessage*. I also like checking scores and sports news."

Three additional categories of technology devices were also discussed including television, cameras, and specialized technology. Although television is likely available at all households, when the topic of television was discussed, participants sometimes mentioned that they watch their favorite shows both on TVs and other devices. In one group of Grade 3 students, the participants reported on the number of TVs in their homes. Paige L specified that in her home, they have "like six TVs." Cameras, both digital still and digital video, were discussed both as features of other devices, such as iPad, and as dedicated devices. Among all of the discussions, 20 dedicated cameras were discussed, mostly for taking photos of family events. Amanda B, a Grade 6 girl, reported, "I have a camera, too, but it's my own so I take it on like vacations and it takes pictures." In another discussion of family photos, Owen S mentioned, "Yeah, I don't like the cameras and stuff. I don't want to like stop and take time to take a picture," to which Bryan T responded, "Yeah, that's more of a mom thing to do." Finally, ten specialized technology devices were discussed, including four remote-control toys (one with iPhone-based controls), three specialized music devices (two MIDI keyboards and an audio signal processor), two participants who program LEGO MINDSTORMS robots, and one advanced scientific calculator (TI N-spire CAS). In one example, Travis T, a Grade 8 boy who uses a piano keyboard and music apps, reported, "There is an app out now where you can create sheets with chord changes and what not. It goes right along and you can change all the chords. So I am able to use it to teach myself music..."

The review of literature included several researchers who studied the technology use of college-age students (Lei, 2009; Kennedy et al., 2008; and Bennett, Maton, & Kervin, 2008). Most of the college students reported in the review of literature were born

approximately 12–16 years before the students in the focus groups of this study. Lei (2009) reported that college students engaged in online social media, Internet surfing, and using technology for school projects. Kennedy et al. (2008) observed technology use including entertainment and peer-communication such as instant messaging, texting, and social networking. Bennett, Maton, and Kervin (2008) reported high levels of ownership of technology devices such as computers and mobile phones. Despite the 12–16-year age difference between the college-age students and the students in these focus groups, the descriptions of technology use among the college-age students apply equally to the focus group students of this study, especially students in Grades 6–8. One possible explanation of these similarities is that the college studies were conducted up to four years ago and during that time, technology use has "filtered down" to younger students, and availability of these services and devices has become more widespread. Another possible explanation is that overall technology ownership and access is greater in this affluent community.

Finally, these focus group discussions may not necessarily provide a complete list of all devices available in each home. The questioning protocol asked students about their uses of technology, not devices; therefore, the reports from participants are likely skewed to the systems and devices that participants actually use. Most of the comparable data reported in the literature was derived from survey data. The survey format likely provides more accurate lists of specific devices, but may not address the survey participants' use of those devices. In this study involving focus groups in an affluent community, it is likely that these participants have *more* devices and systems than those discussed. The

level of detail provided in these focus group discussions likely indicates that the devices and services presented here are those used regularly by the participants.

Gaming

Regardless of the age or gender of students, gaming was described by all participants in all focus groups as a form of entertainment experienced individually, with friends, and with family members. Gaming was also described as occurring on a variety of platforms, both on dedicated gaming consoles and on devices with a variety of functions. The types of games played include many genres: strategy games (i.e., *Angry Birds, Cut the Rope*), first-person shooter games (i.e., *Call of Duty, Halo*), sports games (i.e., *Madden Football, Wii Sports*), action games (i.e., *Temple Run, LEGO Star Wars*), word games (i.e., *Words with Friends*), and others.

The two types of dedicated gaming platforms reported were console games and handheld games. All participants reported that they had access to a total of 74 game consoles in their homes including Microsoft's Xbox (e.g., Xbox LIVE, Kinect), Sony's PlayStation (versions 2 and 3), Nintendo GameCube, Nintendo Wii, and Nintendo 64. All participants reported that they had 26 dedicated handheld game systems available including Nintendo DS (e.g., DS light, DSi), Sony's PSP (PlayStation Portable), and Nintendo GameBoy (e.g., Advance, Color). Eighty iOS devices were reported including iPod touch, iPad (e.g., iPad, iPad 2), and iPhone (e.g., iPhone 3G, 3GS, 4, 4S). In addition, 14 electronic book readers capable of playing games were reported including Kindle, Kindle Fire, and Nook.

A total of 73 games were mentioned by participants. While several of the games are available for multiple gaming platforms, participants usually stated the gaming

platform they used for each game. Among the participants, 31 of the games mentioned are primarily console games, 34 games are primarily iOS or other personal platform games, and 6 are primarily played on computers or websites. The top ten games mentioned reflect these proportions:

- *Angry Birds,* mentioned 39 times, played primarily on iOS devices
- *Call of Duty* (three versions), mentioned 31 times, played primarily on console systems
- *Madden Football* (2 versions), mentioned 18 times, played primarily on console systems
- *Temple Run,* mentioned 13 times, played primarily on iOS devices
- *Cut the Rope,* mentioned 8 times, played primarily on iOS devices
- *LEGO Star Wars,* mentioned 7 times, played primarily on console systems
- *Halo,* mentioned 6 times, played primarily on console systems
- *Type to Learn,* mentioned 5 times, played primarily on computer
- *Wii Sports,* mentioned 5 times, played primarily on console systems
- T*iny Wings*, mentioned 4 times, played primarily on iOS devices

The second-most-mentioned game console, the Nintendo Wii, was frequently described as a game system most families have, but do not play regularly. For example, Chris E in Grade 3 said, "We disconnected the Wii for the Xbox. On Xbox I like to play NHL, it's hockey, and *Madden*." Owen S in Grade 6 said, "I have a Wii, too, but I got that one before the Xbox, actually, and now that I have the Xbox, I kind of like that better." The Wii was also described as used for family gatherings or when adults and children play together. Grade 6 girl Grace H mentions, "I have like a Wii... We usually

play it when we have family over 'cause then we all just play Wii." Finally, the Wii was also described as a pastime when visiting relatives. Grade 3 girl Emma C said, "My grandparents got for the holidays last year, got my cousin, my brother, and I...the Wii. We have it at their house... The only thing there is to do at my grandparents' house is to play the Wii." Laura C, a Grade 7 girl, conveyed a similar situation, "I have a Wii. We have one at home but normally we play at our grandparent's house. They bought a Wii for us for Christmas."

Participants who are gamers or who have siblings who are gamers are aware of which games are considered violent. The most popular console game discussed was *Call of Duty: Modern Warfare 3 (MW3)* by Activision. *MW3* carries a game rating of "M" (Mature 17+) that specifies "Blood and Gore, Drug Reference, Intense Violence, and Strong Language" (Call of Duty, 2012). When discussing *MW3,* Tim B, a Grade 5 gamer reported, "I got a...limited edition one with the special *Call of Duty* carved design on it with two controllers and a free copy of the game. Very violent game. I don't recommend it to too many people." A Grade 3 student with older brothers, Clara Y, reported, "There's the new *Call of Duty* that all the teenage boys want now... It's pretty violent, but if you turn on 'not-too-bloody mode' then it's not too bloody."

In addition to family gaming on the Wii, participants described situations when parents play games with their children on other platforms. Jane V, a girl in Grade 8, said, "My dad surprised us with an Xbox with Kinect for Christmas... That was almost as much a present for him as it was for us 'cause he wants to mess with it and do NXT[6] stuff with it somehow." Grade 5 girl Audrey L described her family playing *Madden 12,*

My brother and my dad, you can hear them screaming all the way from downstairs, "Oh! No! Get the football! Tackle him! Blah, blah, blah!" They are playing the football game and you see them both come up at the same time, "it's halftime." It's really funny.

These focus group anecdotes also serve as examples of Horst's (in Ito et al., 2009) observation that some families use technology and media as family bonding experiences. In general, participants described gaming as a recreational activity. The many researchers who have written about the educational possibilities of computer games reported in this study's review of literature (Dessoff, 2010; Gee, 2008; Gee & Levine, 2009; Gee, in Walser, 2011; Prensky, 2006; Shaffer, 2007; Ito and Bittanti, in Ito et al., 2009) offer compelling ideas about using high-quality games in school to engage learners. However, until a game emerges from the market that is well-designed and demonstrates high educational and game-design standards, the idea of gaming in education will likely remain theoretical.

Electronic Book Readers

The topic of reading electronic books was raised in 10 of the 17 focus groups. In most discussions, participants who read electronic books used Kindle or Nook devices designed primarily for reading electronic books. However, owners of Kindle and Nook devices did not limit their electronic book reader use to reading. For example, Brooke C, a Grade 8 girl said, "I got my Kindle Fire which I use every night for everything... I have like the *Angry Birds, Paper Toss,* that kind of stuff... I use that all the time for reading, games, streaming TV, all that..." Jane V, a Grade 8 girl, mentioned that, "with my Kindle Fire, what I realized I could do was I started typing all of my papers up on it."

Three participants reported using the iPad as their primary platform for reading electronic books. In a discussion about iPad use, Grade 6 boy Bryan T said, "...you can also download books on there which is cool." Participants reported using two different methods of downloading electronic books, Apple's online iBook store and Amazon's *Kindle App for iPad.* Joey D, a Grade 8 boy reported, "I do use *iBooks*. That would be my first choice to go to when I come home from school." When Grade 4 boy Aidan M was asked if he had a Kindle, he replied, "I have a *Kindle app*." Bryan T, a Grade 6 boy, offered, "We just use the iPad, you don't need to pay for a Kindle if you have an iPad. That's my opinion."

On a few occasions, participants mentioned that they liked electronic books for convenience, ease of use, the availability of less expensive books, and other features. Hanna N, a Grade 8 girl said,

> I got a Kindle and...I love it. I am missing books a little bit, but it is really easy and you have the book right there and you don't have to go to the library and go get it so I just think I love that.

Grade 5 boy Dan M observed, "Even though Kindles are expensive, the books are cheaper on it." Audrey L, also in Grade 5 said, "Kindles are cool 'cause you don't get paper cuts and you can bookmark and stuff." Although a formal survey was not administered to focus group members regarding the number of electronic book readers available, the discussions indicate that electronic book use among these groups likely exceeds the 25% use reported by similar age groups in Project Tomorrow (2011). This increased use of electronic books in this population is likely due to the increased

availability of technology devices in general in this affluent community and the introduction of the iPad after most comparable research was conducted.

The wide availability of multi-function electronic book readers is one indication that very soon, districts will need to make decisions about the future of traditional textbooks in schools. The students in these focus groups are regular users of both the reading functions of electronic book readers and have already embraced the additional interactive functions offered by this technology. The electronic book medium for distributing updatable, customized, rich, and interactive content seems to be a compelling solution for teaching and learning, provided the costs and management of the electronic book readers and content are lower than the costs of traditional paper books.

Television and Online Video

The subject of television was raised in 9 of the 17 focus groups. The first topic raised in each focus group was some form of the question, "When you think of the technology you use outside of school, what are the first things that come to mind?" In 6 instances, participants included TV as a technology example. For example, Grade 7 boy George D's first response was, "I think TV or computer." A Grade 7 boy in another group, Mason S, offered his first response as, "Um...I watch TV a lot." Grade 6 girl, Becky E's first thought was, "I watch TV...and I text..."

In a few instances, participants realized that the topic of television had not been mentioned or had been taken for granted as a form of technology several minutes into the focus group. After many other topics of discussion, Grade 4 participant Nick A offered, "I know something we have not mentioned yet, TV." In another Grade 4 group, Sally J asked, "Would TV count [as technology]?"

Watching television content was not limited to viewing it on a TV. Participants mentioned that in addition to watching a TV, they watch their favorite shows on computer, iPad, and Kindle Fire. Grade 5 boy Sean B stated, "Actually I do watch TV on an iPad sometimes." He later added, "You can also watch videos on Apple TV and stuff. You can get pictures and download videos on that, too." Becky E, a Grade 6 girl and fan of reality TV said,

> I watch TV on my computer. 'Cause on Monday there was like this show called *Fear Factor*...it wasn't On Demand so I went to nbc.com and they have all the shows and you can watch the episodes. So I usually do that.

The topic of watching YouTube videos online for entertainment was also mentioned. Six of the focus groups mentioned YouTube 27 times. Grade 7 boy Bennett K offered, "I usually just watch videos and stuff on YouTube and play games online." A Grade 7 girl, Char J, said, "...sometimes I'll go on YouTube or whatever and there you'll see just random things on the sidebar that are recommended videos..." In a conversation among a group of Grade 4 students, YouTube was viewed by all four participants:

> Sara S: "Uh, I like watching videos—YouTube."
>
> Anna C: "Yeah, YouTube."
>
> Aidan M: "I watch YouTube a lot."
>
> Zak M: "I watch YouTube videos, too."

Imposed Limits on Technology

The primary area where participants reported their parents imposed limits was in the use of social media. Facebook and Twitter were the only two social media services mentioned as used by participants. Twitter does not include an age limit as part of its

Terms of Service (Twitter, 2011). However, Facebook's Statement of Rights and Responsibilities states an age limit of 13 as the minimum age for users (Facebook, 2012). As part of Facebook's signup process, users indicate their date of birth, and if a user has reported their age as younger than 13, the service does not allow them to create the account. At the time the focus groups were conducted, 10 of 55 participants were age 13 or 14.

Only three participants indicated that they were Twitter users. All three users were age 13 or 14 and none indicated that their parents had imposed limitations on their Twitter use. One participant uses Twitter as his primary method of receiving information about his baseball league. Mason S, a Grade 7 athlete reported,

> I have a Twitter account that is just used for getting information on baseball... I only do it for baseball so I just have an account that I tell the coach when I'm not going to be there and get information about what's coming up.

The topic of Facebook was discussed by 15 participants. Participants as young as Grade 3 were aware of Facebook's age limit. Grade 3 girl Clara Y stated, "...you can't have a Facebook account until you're 13," and Grade 6 boy Bryan T said, "I only know one kid in this school [of students in Grades 5–6] who has Facebook and Twitter and he's not supposed to, really." Four participants indicated that they have Facebook accounts and all were at least 13 at the time of the focus group. One 13-year-old girl, Steph T, reported, "Well, I got this thing for church 'cause we are going on a missionary trip and they wanted us to get a Facebook page to contact them."

Three participants over age 13 reported that their parents had specifically told them that they could not have a Facebook account. Jane V, a Grade 8 girl, said, "...I don't have a Facebook or any of those other things. My mom doesn't want me to." Sophie L, a Grade 7 girl, had spoken with her parents about Facebook and reported,

> My mom does not disagree with [Facebook], she says I can just not have one now. She has one, my dad has one. Just that in seventh grade she knows I'll be on it a lot and she knows not everyone is on it yet. If they were, she would agree, but now it's not necessary.

Another area where participants reported parent restrictions was in using video chatting and instant messaging services. Participants and their parents were aware that instant messaging services offer multiple communication methods including typing messages and video chat. One participant was able to get her parents to agree to allowing her to use the typing features of the AOL Instant Messenger (AIM) service, but not the video chatting feature. Becky E, a Grade 6 girl, said, "AIM...took a lot of convincing for my parents so I'm not allowed to video chat..." Brooke C, a Grade 8 girl, offered,

> I am very restricted communicating. I have an email, but my parents can block people if they don't want me to go to people like I don't know. I don't have Facebook, I don't have AIM, I don't have a cell phone, so like all I use is email regularly...

Much conversation regarding parental technology limitations centered on mobile phone ownership, texting from a mobile phone, and using a mobile phone for specific situations. Discussion about having access to one or more mobile phones for talking or texting occurred in all focus groups and 55 mobile phone devices were referenced. Only

five participants did not talk about mobile phones specifically, but four participants reported having access to more than one mobile phone in their family. Of the 55 participants, 35% (19) reported that they have their own mobile phone.

Some participants who have their own mobile phone also reported use limitations. Jane V, a Grade 8 girl, has her own phone, but reports,

> My parents, even though I promised I'd pay for texting, don't really let me text...sometimes I just do it—but then I have to pay for it. So unless my parents tell me to text them, then I don't have to.

Jake S, a Grade 8 boy, mentioned that his parents allowed him to get a phone, but with reservations, "My mom and dad hated the idea of getting a phone for me, but since I was going to [high school] next year, they thought I should probably have one." Brooke C's parents also allowed her to have a phone, but for a specific purpose,

> I got my phone...in fifth grade when I was biking between [two schools] every single day alone for [summer] camp so they wanted me to have it just for safety things 'cause I was biking home with my sister who was like 7 at the time.

Finally, Owen S, a Grade 6 boy reported,

> Well, I have like a bad cell phone, but then I also have an iPod touch and I can text on that. So that's usually what I use, but I mean, my phone, my mom only bought it for me because for like emergency purposes.

Other instances of limitations were also discussed. Eric H, a Grade 4 boy mentioned a few instances of limited access to TV content, "I watch some of *The Simpsons,* not all of them, 'cause my dad has to supervise them for us." Eric H said, "my

mom says *[Call of Duty]* is too violent... She said *Halo* and *Call of Duty* can't be in the house. 'You can't play those until you are sixteen. You can never play *Call of Duty.*'" Grade 3 boy Evan S reported that, "My mom doesn't really let me go on the Internet without supervision unless it's for a report." Laura C, a Grade 7 girl, said, "I have a limited amount of hours I am allowed to watch TV so I don't really watch it that much. But when I do, I always like to watch my favorite shows." Finally, a Grade 4 girl Sally J reported that in order to get her own Apple ID (a username required for iTunes Store access), she used a false age, "I think I might have told them I was in my 40s." However, Sally J also said that she was permitted to use her mother's iTunes account when making purchases.

The focus group discussions regarding parental limitations relate to the "media rules" reported by Rideout, Foehr, and Roberts (2010). Like the Rideout, Foehr, and Roberts study, older participants reported having fewer media use rules than younger participants. Focus group participants volunteered information consistent with the Rideout, Foehr, and Roberts report, citing limitations in computer activity, TV content, and video game selection. However, no focus group participant in this study reported a limitation in topic of "What music they're allowed to listen to."

In general, participants in this study seemed sometimes annoyed, but did not indicate that their family relationships were significantly strained by the limits imposed by parents. The most frequent limits imposed were due to the ages of the participants, a situation that participants seemed to understand and accept. Parents generally seemed well-informed about potential issues with certain technologies and services, and those

who imposed more limits than others had taken the time to explain their reasoning to their children.

Communicating Using Technology

Of the 55 participants in these focus groups, 44 participants (80.00%) spoke about specific methods they use to communicate with technology. The methods discussed included text instant messaging with AOL Instant Messenger (AIM), video chatting with AIM, text instant messaging with Apple *iChat*, video chatting with *iChat*, video chatting with Skype, video chatting with Apple *FaceTime*, talking on a land telephone line, talking on a mobile phone, texting on a mobile phone, texting on Apple *iMessage*, posting on Twitter, posting on Facebook, emailing, audio chatting on Xbox LIVE, posting on message boards, and talking on walkie-talkies.

Just less than half of the participants in Grades 3–4 (9 out of 20 or 45.00%) spoke about using technology to communicate. Students in Grades 3–4 mentioned one or two communication methods each, an average of 1.56 technology-enabled communication methods per participant. However, 34 of 35 students in Grades 5–8 (97.14%) mentioned between 1 and 5 methods of communication each, averaging 2.94 technology-enabled communication methods per participant.

Participants in Grades 3–4 primarily reported using technology to communicate with family members. Evan S, a Grade 3 boy, said, "I use the phone to text my mom and call her when she's on business trips." Emma C, a Grade 3 girl, related a family ritual,

> ...my dad...reads *Harry Potter* over the phone with a speaker phone when he's away on a trip. He brings the book—it's like this thick. I'm on the

> fifth book...he's just holding the phone and we're just sitting there on my brother's bed and he's on speaker phone.

Participants in Grades 5–8 reported communicating both with peers and family members and used more technology-enabled communication methods than younger participants. Jake S, a Grade 8 boy, said, "...texting and AIM and Facebook. Email, basically is just for...film stuff, it's just sending files, editing... Facebook would probably be the most useful."

Mobile phone use was the top-reported communication method among all participants. Twenty-four participants indicated that they regularly talk on mobile phones, while 23 participants indicated that they text message on mobile phones. However, texting was preferred over calling when participants elaborated on their mobile phone use. For example, Bryan T, a Grade 6 boy, said, "No one really calls these days unless, like, you can't get a hold of them by text." Travis T, a Grade 8 boy, stated, "For the most part, I usually text more than I call somebody."

Several different methods of video chatting were mentioned by 17 of the 55 participants. AIM, FaceTime, and Skype were the top three choices for video chat. Although each of these services offers text chat, audio chat, and video chat, participants reported using the video chat features most frequently. Hanna N, a Grade 8 girl, told the following story,

> I found *FaceTime* when I got my iPad over winter break and my friend was in Miami and I kept calling her saying "do you want to try this?" and we tried it... I was about to cry 'cause it was so cool.

Tim B, a Grade 6 boy, was one of a few participants to report that his family video chats with extended family members who live far away,

> Sometimes I use my mom's laptop and the whole family does this thing called Skype and you talk to your relatives by...a little camera built into the screen piece and that is how it works. We usually do it with my cousins out in California.

Email was mentioned as a communication method by 13 participants, but it was seldom the preferred method of communication. Jane V, a Grade 8 girl, said, "I email, but I'm not the most regular checker of email. Sometimes once a week...sometimes three or four times a week."

Two participants, Grade 6 gamer Quinn O and Grade 6 gamer Ian M both described a method of communicating while gaming online with other users playing the same game. Gamers wear headsets with microphones using a web-connected audio chat system so they can talk about the action in real time as they play together. Ian M explained, "They have little things for Xbox LIVE where they have microphones...it's very helpful when you want to plan out something or talk to your friends. It's just a good way to communicate while gaming." This communication mode was also described by Hsi (2007) when she noted that "digital kids" work together to solve complex problems, such as those presented in online games, that require distributed teams to solve.

Participants of all ages reported using technology-enabled communication for the purpose of communicating with both immediate and extended family members, especially through video chat services. Although the communication was not reported as frequent, it warranted discussion in these focus groups likely because it was memorable

and made the participants feel connected to their grandparents, aunts, uncles, cousins, or older siblings away at college. These participants also indicate that email has been long replaced by more real-time communication methods such as instant messaging and texting. Finally, the *iMessage* service has been quickly adopted by younger participants and those without their own mobile phone as a way of texting on a personal device such as the iPod touch or iPad. This adoption of *iMessage* is an example of a relatively rapid adoption by participants of a brand new service that was first released on October 14, 2011 (Apple, 2011a), just three months before it was mentioned by name in a focus group held on January 13, 2012.

Technology in the School Environment

When participants were asked to identify the school projects they had completed using technology, 68 activities or projects were cited in 16 categories (listed from more to less frequently mentioned):

- *iMovie,* video, and Flip video projects
- *GarageBand* music projects
- typing exercises
- open-ended choice projects
- *Keynote* and *PowerPoint* presentations
- *Comic Life* projects
- "extra math" opportunities online
- using laptops
- typing writing in *Word* or *Pages* word processing applications
- playing games on websites

- writing blog entries
- computer art projects
- *Scratch* programming
- *Froguts* virtual 3D dissection
- using network sharing and networked computer accounts
- using iPads

The projects that participants preferred most were video creation projects. Video projects were mentioned nine times. Clayton K, a Grade 6 boy, said, "I kinda like doing like video work better than typing work or audio work. I just like doing video stuff." Becky E agreed,

> I think it's helpful when you're trying to do kinda like a project you can videotape it, put it on the computer, and...we can make it kinda like our own and make all the like transitions and things... [It's] more us doing it than...just trying to remember it.

In the same group, Ian M also described a video project that involved recording and editing a video about a flag football game, "I thought it really kicked in the use of technology for usefulness."

Participants also shared school technology integration projects or activities that they disliked. Fourteen major categories were discussed, but ten of the issues were mentioned only one or two times and included very specific examples such as blocked websites, software features, or the dislike of using an application. Overwhelmingly, participants disliked typing exercises. The six students mentioned above who liked typing exercises did not elaborate on what they liked, but the students who disliked typing

exercises mentioned that they were bored by the repetition of the typing exercises and some offered solutions. Grace H, a Grade 6 girl, defined the issue,

> When we were little, we had to do some typing exercises... They had these like little things that like sang and danced. It got really annoying... In third grade and at the end of second grade we did it for like a month and then in third grade we were just all sick of it already.

The four participants in that group also offered a possible solution:

> Bryan T: "Do it in a better program."
>
> Owen S: "Yeah, I think different exercises."
>
> Grace H: "Try out different programs. Do that program one year and like a different one another year."
>
> Owen S: "And also do like less time on it 'cause that was like way too long."

Two specific comments in another category presented as dislikes are notable because they complement statements made by participants above who enjoy open-ended and creative projects. Grade 7 boy George D offered, "I don't like projects that are really strict. Like 'you have to do this'... I like when you can do what you really like to do for a project." Laura C then gave an example,

> One project we had to do last year, we had to do this podcast on today's music... I remember we had to type up the script and told us exactly what we had to say so none of it was unique. You added background music and stuff so she rated us on saying the exact same thing and stuff, and I really didn't like that.

In general, technology-integrated project-based learning seemed to be the preferred method of learning among the participants in these focus groups. Most examples described involving video, music, presentations, and art were projects (or parts of a larger project). These types of project choices reaffirm Wagner's (2008a) "survival skill" of effectively using verbal, written, and presentation skills to focus and communicate. Six of the participants mentioned that they preferred technology projects that were creative and offered a choice to students. All six of these students were in Grade 6–8, likely because older students have had more experiences using technology to create projects. In addition, these students reported enjoying the opportunity to personalize their learning. Laura C, a Grade 7 girl, said,

> Well, my favorite project that we've done this year is this project we are doing in social studies 'cause he gave us a lot of freedom to use technology and stuff so I made a movie and I also made a song like a parody to "Sexy and I Know It." It was really fun and me and my friend...had a great time making it.

Laura C's project is also an example of youth using work by another creator they found online as inspiration for a project (Lange & Ito in Ito et al., 2009). Nate Y, a Grade 8 boy, said,

> ...social studies projects are ones I enjoy doing. We did one on the assassination of Abraham Lincoln and that was a really fun one. Anything really with a cam where we can be really creative with it and we can go out there and just work on it.

When discussing technology integration in school projects, the most frequent general patterns discussed by focus group participants were freedom of choice and the use of technology to create authentic projects that allow students to demonstrate self-expression. Older participants valued the choice of being allowed to select the technology medium to complete projects. Several media were mentioned including videos, podcasts, presentations, graphics, and writing. In order to allow participants to choose from a variety of technology project options, it will be important to continue to offer a variety of technology integration project experiences to students of all ages so several selections are available. The example of the student who disliked the script-driven podcast is one indication that students are capable and interested not just in choosing the medium, but also in having the opportunity to extend their creativity and voice into the structure and content of technology-integrated projects.

Other Observations

The seven major categories above were derived from topics mentioned most frequently in the focus groups; however, many other interesting topics were discussed less frequently. This section includes those topics that did not warrant a major section: listening to music on multi-function devices, Apple's Siri voice recognition technology on the iPhone 4S, "technology awareness" among younger participants, and video creation as a hobby outside of school.

Seventeen participants in all grade levels reported listening to music as a pastime. Fourteen of those seventeen participants reported using an iPod or other multi-function device for listening to music. Jessica A, a Grade 3 girl, said that she enjoyed, "Listening to music on my iTouch." Grade 7 girl Sophie L reported, "I also think of...iPods. We

always listen to music, and always texting and talking and taking pictures and stuff." A few participants mentioned that they enjoyed listening to music while traveling. Grace H, a Grade 6 girl, also uses an iPod touch, "Well, when I travel for like music and mine's like hooked up into my alarm so it wakes me up each day." Laura C, a Grade 7 girl, said, "I'll use [my iPod touch] on the airplane and stuff when I travel with my family and stuff. And I listen to music, play apps, call people and *FaceTime*."

Although the time spent devoted to listening to music was not referenced in the focus groups, the fact that some participants referenced music listening as a pastime was not surprising. Rideout, Foehr, and Roberts (2010) reported that on average, children age 8–18 listen to music and other audio for 2 hours, 31 minutes, while media multitasking. It is likely that participants in this study listen to music in similar patterns to the Rideout, Foehr, and Roberts (2010) report, given the ages of the participants and the high access they have to multiple devices that play music.

The topic of Siri voice recognition technology was raised in four focus groups and discussed by eight participants in Grades 3–6. Siri technology, a feature available only on the iPhone 4S at the time of these focus groups, was mentioned by participants in the contexts of entertainment and experimentation. According to Apple, the developer of Siri technology,

> Siri on iPhone 4S lets you use your voice to send messages, schedule meetings, place phone calls, and more. Ask Siri to do things just by talking the way you talk. Siri understands what you say, knows what you mean, and even talks back. (Apple, 2012)

Participants enjoyed telling their stories about what they asked Siri. Gina B, a Grade 4 girl, said, "I like to use my dad's Siri. I like talking to it, it's fun, asking random questions, like 'will you marry me,' and it's like, 'no, we hardly know each other.' It is kinda weird." Anna C, a Grade 4 girl, was quite excited to relate her Siri story:

> I asked it once "where can I hide a body?" and it said, "in a mine" and it listed like, "in a ditch, in a dumpster, in a mine, in a cave," and I clicked on "mine" and it's like, "here's the nearest mine."

Clara Y, a Grade 3 girl in another group, related a more typical application,

> ...there's another thing on the iPhone 4S...where you can just talk to it without pressing any buttons, you just say like, "Will it be sunny in Miami?"...Then it would say, "It would be sunny in Miami. Better bring your sunglasses."

Although the stories related by participants regarding the use of Siri were primarily mentioned as entertainment and experimentation, the fact that participants show this interest may indicate a future for everyday uses of voice recognition as the technology matures and the participants become more accustomed to it. The examples here each represent the idea of a possible legitimate use: Gina B enjoyed "asking random questions;" when Anna C asked, "where can I hide a body?," she experienced an example of a location- and context-aware answer to her question; and Clara Y asked a weather-related question, a topic for which she reported great interest. As the novelty wears off Apple's Siri technology and if its use becomes more widespread, these participants may be representing future users of this and similar technologies for interacting naturally through speech with their devices.

Younger children with older brothers and sisters revealed that they were more "technology aware" than children without older siblings, and they also sometimes exhibited that they were more aware of content usually reserved for older children (or young adults). Grade 4 boy Eric H, who reported that his dad supervises which *Simpsons* episodes he is allowed to watch, said, "My brother is like 14 and he is always watching *Family Guy.* So sometimes when he is babysitting I watch that with him." *Family Guy* carries TV Parental Guideline ratings of TV-PG (Parental Guidance Suggested), TV-14 (Parents Strongly Cautioned), or TV-MA (Mature Audience Only), depending on the editing of each individual episode (TV Parental Guidelines, 2012). Audrey L, a Grade 5 girl with older siblings said,

> I have a Playstation and my brothers and I usually play *Modern Warfare 3.* My brother for his birthday got this controller instead of it having buttons, it has bullets 'cause he memorized all the buttons... My favorite one is called "Capture the Flag" 'cause they are busy shooting people and you can go inside the house and just jump out of a window and get the flag and run back. They are just focused on shooting people so it is easy to win.

Modern Warfare has a rating of "M" (age 17+). An additional example of a younger student with access to older content already mentioned above includes, Clara Y, a Grade 3 girl, who talked about both *Modern Warfare's* "not-too-bloody mode" and Facebook's age restrictions.

Gina B, a Grade 4 girl, is one of six children in her family with four older siblings. Her oldest sibling is 17 years old. Likely as a result of being part of a large family, Gina B was far more informed about and had access to more technology than

other participants her age. She mentioned having access to two Xbox 360 consoles, a laptop, and two desktops, with one desktop in her room. She also discussed "fake calling" apps and FaceTime video chat pranks, topics not discussed by others her age. In addition, Gina B reported playing at least one game, *Call of Duty: Modern Warfare,* with a rating of "M" with her brothers. (Gina B is age 9 and the "M" rating is for ages 17+.)

At the same time, Gina B also reported participating in Fantasy Football with her immediate and extended family. She explained,

> I do this thing called Fantasy [Football] on nfl.com. ...you pick all your players from the NFL and I do it with my uncle, my uncle, my cousin, my cousin, my cousin, my sister, my sister, my brother, my brother...we all pick players and use them. If they get injured, we can't use them anymore. It is really fun. And I came in third place.

Gina B was also aware of an online Wikipedia protest that had recently occurred. "Did you know Wikpedia was on strike? You could not research anything. Everything was shut down."

The issue of content and technology exposure due to older siblings appears to have both positive and negative effects and consequences. On the negative side, participants as young as Grade 3 reported both watching and playing violent games intended for mature audiences. Less extreme content issues reported were younger participants watching animated TV shows with varying degrees of adult themes and references. In no case did a participant report that they were negatively affected by exposure, but most did imply that they were aware that the content was beyond their age limit. On the positive side, some aspects of exposure included playing games that require

teamwork as a family and learning about current events. Thus, depending upon each situation, technology and content exposure can potentially demonstrate positive or negative outcomes.

Related to the findings above that participants enjoy creating video productions as school projects, several participants mentioned that they enjoy creating video projects outside of school for fun. Nine participants in Grades 4–8 reported making videos outside of school for fun. Andy M, a Grade 4 boy, reports, "My friend makes YouTube videos with me and other people and we get like five hundred views a month." Bryan T, a Grade 6 boy, said, "At my house I used like what I learned in computer literacy and I made a video about my little sister." Laura C, a Grade 7 girl, added,

> ...one of the things I really use on my computer is *iMovie*. I use it a lot if I am making a video for school or...sometimes we go on a family trip and I take a lot of photos and I put them all together in a movie.

Jake S, a Grade 8 boy, clearly views video production as an area of major interest. According to the definition of Ito et al. (2009), Jake is exhibiting an example of "geeking out" in his video production pursuits. He reports,

> I co-run a YouTube channel with my friends and we currently have a partnership. It's pretty fun. We get a little bit of money from YouTube...we film videos every week and edit them. So we film them on Saturday and edit them on Sunday and we use usually Adobe *After Effects* and *Final Cut.* So that's basically what we do and sometimes the occasional *Blender* or *BOOJOO* or something like that.

After the focus group, Jake S shared his YouTube channel. His video projects showed a high level of expertise in all aspects of video production and digital special effects. Jake is demonstrating several "twenty-first century skills" as identified by a variety of researchers through his YouTube partnership. First, he and his partners are exhibiting what Wagner (2008a) referred to as the skill of "initiative and entrepreneurship." Further, this YouTube channel demonstrates Hsi's (2007) idea that "Digital kids engage in self-expression to create their own online media." Finally, Jake S described through his conversation the exemplification of using the web to self-teach skills, "playing around with" software, and working with peers that was reported by Lange and Ito (in Ito et al., 2009).

Conclusion

The Technology Device Access and Use section identified that the participants in these focus groups have access to a wide variety of technology devices and services in their homes and that they regularly use these devices for entertainment, gaming, communication, schoolwork, and other uses. A variety of gaming platforms and potential gaming systems are in use as participants play games as recreational activities and as family bonding experiences. Electronic book readers are also widely available among participants and used both to read electronic books and for other functions. Both television and online video were mentioned as recreational and learning activities with participants accessing video and TV content on a variety of platforms and on sites such as YouTube. Participants discussed their imposed limits on technology in their homes in several areas including social network access, mobile phone ownership, and limits on content. The Communicating Using Technology section discussed various technology-

enabled communication methods with texting, instant messaging, and video chat highlighted. The Technology in the School Environment section presented a variety of project-based learning examples and revealed student preferences for certain project types and for student selection of technology media. Other observations included listening to music, Siri voice recognition, the increased "technology awareness" of some younger participants, and video creation as a hobby. Clearly, students are bringing experiences and skills into the classroom that they have gained and developed on their own using technology outside of school. With these findings and interpretations about student technology uses in mind, several judgments and recommendations will be offered to suggest ways that teachers and parents can use this information to enhance teaching and learning.

SECTION FIVE: JUDGMENT & RECOMMENDATIONS

Four categories of recommendations are presented here based upon the analysis of this study. The first section, "Knowing Our Children: Teachers," discusses the importance of knowing technology uses, skills, and interests as a part of knowing "the whole child." The next section, "Knowing Our Children: Parents," suggests informing parents about what is known regarding student technology use. The section "Welcome Student-Owned Technology in School" encourages school districts to prepare to allow students to bring their own devices to school for learning. Finally, "Encourage Project-Based Learning Opportunities" advocates that teachers increase the depth of project-based learning opportunities offered in the classroom.

Knowing Our Children: Teachers

The school district in which these focus groups were conducted strongly identifies itself as a leading public school district practicing progressive education. One important aspect of progressive practice is that teachers know their students well from a variety of perspectives. The district's vision states that

> We are a dynamic community of learners committed to respecting childhood, challenging the intellect, nurturing creativity, fostering reflection, encouraging action, and exploring possibilities for the future. We believe that a developmental, child-centered approach to education is the most effective way to meet the needs of our students and the high level of expectations we set for them. (Winnetka District 36, 1999)

Progressive educators must have an understanding of student interests both inside and outside of school. In an early book describing the tenets of progressive education,

Carleton Washburne (1952) wrote, “The progressive schools were often referred to as ‘child centered schools’—the work grew out of children’s interests and needs.” Further, Washburne recognized that,

> ...school is only a focal point in education, and that the child has far more experience and learns far more at home and in the community than in school. Instead of shutting out the world outside, it takes the child into it, and draws it into the school. (Washburne, 1952, p. 15)

Conversations with teachers, administrators, and parents regarding student technology use over the years have revealed that while adults in schools are certainly aware of student access to and use of technology at home, specific student technology uses are not known. In the course of this study, some teachers were able to identify a few students whom they felt were interested in technology, but only general impressions about technology use were discussed. Further, teachers and administrators expressed surprise at more than one student’s specific technology interest when it was mentioned after focus groups had been conducted.

By no means is it implied that student technology interest and use are being intentionally disregarded by teachers and administrators. Instead, it is believed that some educators, even progressive educators, do not know to ask students about student technology use in the first place since many adults either do not use technology in the same way as students or have never considered how student technology use might indicate interests, abilities, or other learning approaches.

One outcome of this research is to share the knowledge gained about student technology with the teachers and administrators. This information will provide immediate

additional options that teachers can use to assign projects and to provide engaging learning opportunities that students themselves have reported and discussed.

Further study is needed to help teachers develop specific protocols for efficiently learning about their students' preferences for technology use both inside and outside of school and how these preferences might relate to student achievement. At least three dimensions regarding student technology use were identified during this study: use, skill, and interest. It is possible that further study would identify specific methods for learning about these dimensions, identify additional dimensions, and most importantly, link these dimensions to learning strategies to help teachers plan and develop activities that promote twenty-first century skills in a progressive education setting.

Knowing Our Children: Parents

Just as teachers may not be fully aware of the technology services and devices used by students, it is possible that parents are not fully aware of the technology-enabled pursuits of their children. This is not to imply that parents are being irresponsible about what their sons and daughters are doing in regard to online or other technological activities, but rather that parents may not know the extent to which their children are involved in technology-based activities or the potential positive or negative effects related to these pursuits. In fact, the limitations imposed in some homes described in this study demonstrate that parents are aware of some potential technology-use risks based upon limits in the areas of social networking, gaming, communication, and content.

Interestingly, no focus group participant in these groups outwardly expressed extreme parent frustration in the context of technology limits. Although Horst (in Ito et al., 2009) reports that children sometimes feel that their parents are "clueless or

incompetent in dealing with the norms and literacies of online peer culture," participants in these focus groups only occasionally reported mild frustration with the limits their parents had set, and some participants stated that they understood the reasoning behind the limits.

Now that this body of information about student technology use is known, it may be useful to support parents by explaining what their children reported knowing about technology and how they use it at home and school by sharing the results of this study. Although every student in the district was not interviewed, the clear patterns that emerged from these focus groups regarding technology use will serve as one way to open a dialogue for families.

In addition, a few strategies for learning about what children do with technology at home can be offered. In many cases, simple conversations about the games, activities, communications, or online pursuits will help parents better understand their child's interests or everyday uses of technology. One strategy would be to ask the child to demonstrate the technology activity while they are engaged in it. Playing games with children, especially for non-gamer parents, is both enlightening and entertaining as the parent will experience first-hand a general impression of a game's content and better understand the mechanics of playing it. In the case of handheld and iOS games, parents may find (as this researcher found) that they enjoy playing some of the games played by their children, leading to the parents downloading the games and installing them on their own personal devices.

Welcome Student-Owned Technology in School

The participants in these focus groups use technology devices and services as a regular part of their lives outside of school. However, in-school technology use is less frequent, especially in Grades 3–4. No focus group participant in the course of this study ever identified themself as being anti-technology, fearful of technology, a "non-technology" user, or expressed any other Luddite sentiment. Indeed, the main issue regarding technology use and integration among this group is that technology use is a non-issue and that students want access to more technology in school. This same conclusion was reported in the Project Tomorrow (2011) study when students in Grades 6–8 responded that they would like to use laptops (51%), smartphones (49%), and iPads (43%) in school and that 62% of students wished to bring own devices to school. The time has come to take steps to make school technology use as integrated as home technology use.

As expressed by the participants, the schools described in this study have technology devices and infrastructure available. Participants described technology-integrated activities and projects as both positive and negative learning experiences. Most of the time, there were few discussions regarding school technology devices, except when participants mentioned that they wanted to use laptops in their classrooms more frequently or use iPads at school. Although not specifically expressed, younger students in this district complete most technology-integrated projects on desktop computers in computer labs, while older students use a combination of desktop computer labs and in-class laptop carts.

The participants in this study indicate that technology ownership of relatively low-cost mobile devices such as iPod touch, iPad, iPhone, Kindle, smartphones, and even laptop computing devices capable of running apps and accessing the Internet is commonplace in their lives. However, rules currently exist in all buildings in the school district that these devices are usually not allowed in the classroom. Students already use these devices outside of school and the devices are already set up with accounts, apps, and resources known and used by students; thus, these devices could be used in school with a few changes to current classroom and district procedures.

To effectively integrate these additional devices, district and school administrators will need to set up appropriate guidelines for students to bring student-owned technology devices to school. Guidelines should include common-sense use statements and should be specified in an acceptable use policy. Some guidelines to address include:

- Allow communication (talking, messaging, texting, audio chatting, video chatting, etc.) at appropriate times before or after school or with teacher consent.
- Allow classroom use of devices in appropriate situations with teacher consent.
- Allow access to Internet services or files for curriculum-related purposes only.
- Silence devices during school hours.

Further, the district will need to explicitly state that current rules regarding cheating, photo consent, video consent, and other behavior and privacy issues continue to apply to the use of personal technology devices in school.

The issues of district technology infrastructure and web filtering also need to be considered. First, network bandwidth (the volume of Internet traffic a network can

support) and wireless coverage (the locations where wireless devices can access the district network) may need to be expanded to support the additional devices students bring. Second, a wireless network for "guest" (or non-district-owned devices) access may need to be created for student and staff use. Third, web-filtering policies would need to extend to a student-accessed wireless network to filter websites accessed on student-owned devices. While these infrastructure issues have some potential setup costs and possible increased monthly service costs associated with them, the core systems are already in place in this school district (and likely most other school districts), and the changes will require little additional support on the part of the district.

Perhaps the greatest potential issue for some school staff would be the implementation and classroom use of student-owned technology devices. One set of issues all teachers would need to address will be the classroom management issues introduced by bringing technology devices into a classroom, such as storage, when to use devices, and how devices might be used. However, the situation will also allow teachers another method to teach responsibility and appropriate technology device use, two skills that all Digital Age citizens need to eventually learn to function in society.

The other obvious area teachers will need to address is how student-owned technology devices might be used in a classroom for learning activities. For teachers who already use one or more of these technology devices themselves, the transition to adding student technology tools will likely not be difficult. Teachers will need to demonstrate the courage and flexibility to both allow students to use their devices and to be willing to learn about new or unfamiliar technology tools the students may bring to class. In a progressive education environment, listening to students and encouraging leadership are

already commonly held beliefs so extending these ideals to student-owned technology devices should not pose a philosophical barrier.

For teachers who perceive themselves as anti-technology, non-technology users, or otherwise limited in the use of technology, it may be challenging to add student-owned technology to the classroom. If a teacher is unaware of the capabilities or potentials of devices due to their own lack of exposure or use, it may be difficult for them to envision uses for devices or services of which they are unaware. However, in a progressive education environment, it is appropriate to allow students to take the lead through both student interest and in selecting individual learning modes. Thus, extending progressive ideals to student-owned technology devices already aligns to philosophy and practice.

Teachers who resist or refuse to use technology in their instruction are denying important learning experiences to their students and teaching in a way that lacks relevance in the twenty-first century. All students deserve to have teachers who will help guide them in the use of technology integration. In a truly progressive education environment—or any education environment—a teacher who cannot adapt to the changing needs of the student and society is demonstrating a major deficiency in their role as an educator.

Finally, professional development opportunities will be crucial for all teachers, both to explain the basic features of the devices that this study has indicated are known to be used frequently by students and to suggest ways student-owned technology might enhance learning activities. An obvious starting point would be providing basic, hands-on experiences for teachers and staff to highlight features of iOS devices (iPhone, iPod touch, and iPad). Demonstrations of Kindle and smartphone features would also prove

beneficial since these devices are pervasive among participants. Just as important, discussion, examples, and modeling of technology-enhanced instructional practices should be embedded within "how-to" information so teachers can begin to develop an understanding of situations when technology integration is most appropriate. Over time, the professional development program will need to be updated, offered at various levels, and taught in various modes so teachers can remain current with the functions of new devices and their possible curricular uses. The goal of these professional development efforts would not be the mastery of all functions of potential learning devices, but to provide explanations of the possible uses and potential educational benefits of using student-owned technology in the classroom.

Encourage Project-Based Learning Opportunities

Participants in these focus groups, especially in the upper grades, stated a clear preference for project-based learning opportunities. While social studies was singled out as the class where they most enjoyed completing technology-integrated projects, participants indicated that they wanted to do more project-based learning in additional subject areas. Laura C, a Grade 7 girl, stated, "If we could do more stuff like we do in social studies I would like that, but in other subjects as well, like doing it in science or math." Since students are clearly engaged by technology-integrated learning, more technology options should be offered by all teachers.

The projects described by participants included creative projects that were presentation-based and activities that allowed freedom of choice in technology modes. However, many additional types and methodologies for project-based learning are available beyond research and presentation projects that not only allow student choices

for creativity, but also require students to make informed decisions about selecting technology tools for communication, data-gathering, data visualization, and other real-world applications. Professional development in the area of Challenge-Based Learning (Johnson, Smith, Smythe, & Varon, 2009), twenty-first century skills (Hsi, 2007; International Society for Technology in Education, 2007; Partnership for 21st Century Skills, 2011; Perkins, 2008; Pink, 2005; Walser, 2011; Wagner, 2008a), and other methodologies provide additional opportunities for students that complement and extend their current areas of interest.

Another obvious area of interest for participants is video production. While it is clear that some teachers are comfortable allowing video as a project choice, the steps involved in video production are not universally known by all teachers. Excellent video productions require the use of several twenty-first century skills. Considering one list, the *National Educational Technology Standards for Students* (International Society for Technology in Education, 2007), most video production projects require at least five of the six standards: Creativity and Innovation; Communication and Collaboration; Critical Thinking, Problem Solving, and Decision Making; Digital Citizenship; and Technology Operations and Concepts. If a video project requires research, Research and Information Fluency would allow all six standards to be represented in a single video project.

While many teachers may have experienced some level of video production professional development in their career, recent changes in the ease of use of current video editing software (i.e., *iMovie, Final Cut*) and video cameras (i.e., iPad video camera, smartphone video camera) may necessitate a "refresher course" in video production. For a teacher to assess a student on all aspects of a video production, a short,

hands-on video production experience is advocated. However, teachers who assign video projects should be exposed to a demonstration of the video production process, or at least ask students to describe the process they used, in order to assess all aspects of the project.

Furthermore, while video is one multimedia format described by participants as a preference, music projects and audio podcasts were also mentioned. Like video production, the applications used to create these types of projects are relatively easy to learn (i.e., *GarageBand*). Professional development opportunities for these applications should also be offered for teachers who want to learn how to use or assess projects that use these and other multimedia applications.

Finally, for students who wish to rise to the level that Ito et al. (2009) describe as "geeking out," in-school opportunities should be provided so these students can both learn more about their areas of interest and also meet and collaborate with other students who share the same interests. Areas that emerged in this study where students revealed high interest, but do not currently have in-school opportunities in the district to explore these areas in depth, include video production, programming, and graphic design.

Revisiting Darling-Hammond and Friedlaender (2008), we are reminded that, "By knowing students well, teachers are more able to tailor instruction to students' strengths, needs, experiences, and interests." Over a half century before, Washburne (1952) wrote that the child "...learns far more at home and in the community than in school. Instead of shutting out the world outside, it takes the child into it, and draws it into the school."

The students in Grades 3–8 in The Winnetka Public Schools represented in this study have an unprecedented level of access to technology devices and services. They use the same devices for playing games, reading books, watching video content,

communicating, learning, and following other pursuits. Students have integrated technology into their lives seamlessly because a connected world is the only world they have ever known. In the twenty-first century, it is impossible for teachers and parents to know and understand "the whole child" without knowledge of the everyday technology experiences, activities, and skills in which students engage. Together, teachers, parents, and students can "tap the screen" to enhance educational practice and help prepare our students for an increasingly digital world.

Endnotes

[1] Machinima [*muh-sheen-eh-mah*] is defined by the Academy of Machinima Arts & Sciences (2005) as "filmmaking within a real-time, 3D virtual environment, often using 3D video-game technologies...Machinima is real-world filmmaking techniques applied within an interactive virtual space where characters and events can be either controlled by humans, scripts or artificial intelligence." The term is a portmanteau of "machine" and "cinema" and also contains a fragment of the term "anime" (the Japanese animation style).

[2] The researcher danah boyd (2011) has chosen to spell her name with lowercase letters. On her website she writes, "I really don't like when people remove the 'h' or capitalize my name—it's not how i've chosen to identify" (boyd, 2011).

[3] The term "app" is an abbreviation for "application" (Merriam-Webster, 2012). In this study (and in most current common uses), apps are software applications that run on mobile devices.

[4] The "iPod touch" device is sometimes inaccurately referred to as "iTouch" by participants in this study (and others). The term "iTouch" was used 29 times in the focus groups, equal to the product's official name, "iPod touch." When referring to this product, Apple states, "Do not use variations such as...*iTouch*" (Apple, 2011b, p. 7).

[5] iOS is the name of the operating system used to run Apple hardware devices with touch screens, such as iPad, iPhone, and iPod touch (Apple, 2010a). This term follows a naming pattern established by Apple: several products are named with a lowercase "i" followed by an uppercase word (i.e., iMac, iTunes, iPad); "OS" is an abbreviation for "operating system."

[6] NXT is a programmable device used to control LEGO MINDSTORMS robots. The LEGO website defines NXT as "the brain of a MINDSTORMS® robot. It's an intelligent, computer-controlled LEGO® brick that lets a MINDSTORMS® robot come alive and perform different operations" (LEGO, 2012).

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