Digital Kids and Digital Tools: How the use of emergent technologies and digital tools support learning in the 21st century.

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"*As we educators stick our heads up and get the lay of the 21st century land, we would be wise to remember this: If we don't stop and listen to the kids we serve, value their opinions, and make major changes on the basis of the valid suggestions they offer, we will be left in the 21st century with school buildings to administer—but with students who are physically or mentally somewhere else."*

Mark Prensky, Listen to the Natives, 2006, p.13

Introduction

Over the past fifteen years, the fundamental nature and use of technology has changed. Through the proliferation of computers, the ubiquity of the Internet and the use of digital tools, schools have been faced with the challenge of considering how and when to use technology in the classroom. Beginning in the early 90's schools began introducing computers in the learning environment— in part to respond to the notion that schools must integrate technology to remain current with educational trends—and in part to augment the instructivist approach that many teachers had taken. Recently with the transformation of the World Wide Web, with even greater changes on the horizon, schools have been faced with an equally compelling dilemma of how to incorporate newer tools and technologies into the learning environment. As new technologies are introduced, schools need to balance the temptation of trying to integrate and implement each new innovation with the need to emphasize trusted learning methods and pedagogy. In the past ten years many researchers have considered how the design of a learning environment influences the way students learn.

My own interest in innovative technology and its influence on learning dates back to the mid 1990's when I was working in a small independent girls' school. At that time, the school made the decision to partner with Toshiba and Microsoft to pilot the "Learning with Laptops" program. The goal of the "anytime, anywhere" program was to help private and public schools acquire laptop computers and utilize Microsoft Office software tools for every student. At the time, this was a radical notion as the use of laptop computers in education was not commonplace. Most of the faculty members at this school did not have experience using computers as a tool in the classroom; many students did not know how to create, edit or save the most basic word document. Later, this school was also an early adopter of "SmartBoard" technology in science and foreign language classrooms. Smart Boards, essential an interactive whiteboard, were

innovative as they allowed learners to interact with the whiteboard—capturing images, annotating notes, exploring web pictures and links—all which could be saved as files for future review. These formative experiences, coupled with those I have had over the past few years, laid the groundwork for my interest in the use of digital tools and innovative technologies in schools.

This interest in the use of technology in schools has been augmented by the work I have done in previous CCT classes. Over the past two years I have completed projects that could be construed as constructivist in nature—I am interested in how students can help to facilitate their own learning. A constructivist learning environment is one where students are challenged to actively engage in the construction of knowledge and their own learning. Based on these past experiences and my present area of interest, I chose to spend my time this semester considering how the use of emergent technologies and digital tools may enhance the learning environment for students who have grown up using technology.

When I first began the semester, I was hoping to develop a "how-to" framework to guide my efforts at my present school. I was expecting to find research on how schools had made the decision to incorporate innovative and emergent technologies—both what technologies to implement and how they would evaluate the success of a particular implementation. Through the process of research and engagement, my interest and focus has shifted slightly—I want to consider how schools can incorporate the use of innovative tools and technologies to enhance the learning environment for both teachers and students. Through my continued research, I hope to develop an understanding of how we can create and maintain learning environments that support the students we are presently teaching and those we will teach in the future.

Over the past fifteen years the experiences and interests of our students has shifted. There is considerable research on how our students are obtaining, processing and sharing information with others—I am curious about how we can modify the learning environment to meet the needs of our students and prepare them with the skills that are needed for college and the workplace. To be competitive in the global workplace they are about to enter, students need to be equipped with what is termed "21st century skills". In addition to core content knowledge, students need skills in critical thinking, problem solving, communication, and collaboration. Without these skills and digital literacy, our students will not be prepared to participate in the global workplace they are poised to enter. One advocate for the innovative use of technology in schools is Will Richardson, author and national advisory counsel member to the George Lucas Education

Foundation. In his article, *Why schools should break the Web 2.0 barrier,* Richardson (2009) notes that those who use technologies in ways to expand their global connections are more likely to advance and succeed while those who do not may be relegated a role as an observer (p. 8). In an article in the journal *Learning and Leading with Technology*, Kansas State University professors and researchers Larson, Miller and Ribble (2009) asserted that in order for students to compete on a global level in the 21st century, everyone in education should be talking about the use of digital tools to enhance teaching and learning (p. 15).

In the past decade, the use of technology has clearly had an impact on how our students learn. No longer is learning confined to the four walls of the classroom or the confines of an academic calendar. According to educational researcher and author Andrew Zucker (2008), schools have already been transformed by digital technology in the following ways:

- Where and when students learn;
- How students learn (the tools they use);
- Who students learn with;
- What students learn (p. 24),

As we explore the potential future impact of technology on education, it is helpful to consider the students we are teaching, the tools they are using and how their learning can be enhanced by digital tools and emergent technologies.

Section 1: Digital Natives

In 2001, author and educational researcher Marc Prensky, coined the term digital native as a reference to today's students. These students, also known as millenials, have grown up with computers and technology all around them. In one of his later writings, Prensky (2006) noted that digital natives are native speakers in technology, fluent in the digital language of computers, video games and the Internet. For these kids, digital tools are like extensions of the student's brain (p.12). This fluency is juxtaposed by the "immigrant" status of most teachers in the schools where digital kids are learning. It is not that teachers are unaccustomed to using technology in their lives both in and out of school, it is simply the fact that they have not grown up considering all the ways it can be used to enhance learning and communication. Prensky (2006) asserted that while teachers may have learned the languages of technology, many still retain the accent of their

non-technological ways (p. 9). This fluency distinction creates a challenge for both teachers and students.

One challenge created by this digital divide is that our students think and process information differently from students who preceded them. For seasoned educators this difference may create a dilemma—the methods of teaching and learning once recognized as tried and true may no longer be as effective. Based on a study funded by the Friday Institute for Educational Innovation at North Carolina State University, researchers Spires, Lee, Turner and Johnson (2008) asserted that educators are further challenged by "need to meet the needs of children who live in a world of ubiquitous information and communication-related technologies" (p. 497). In his seminal work involving digital kids, researcher and author John Seely Brown (2000) emphasized that for children who have grown up in a digital world, they are hyperconnected and thinking about ways to multiprocess (p. 13). These digitally literate, mobile, and always connected learners are motivated by their need to communicate with others (Brown, 2000; Prensky 2006; Solomon and Schrum, 2007).

While some adults may be concerned with adolescents need to use and tinker with innovated tools, there is an upside to this curiosity and intrinsic motivation. Prensky (2006) emphasized that the students we teach are innovative users of technology, constantly motivated by and engaged with the adoption of new innovations and systems (p. 10). In the journal *Educational Researcher*, authors Christine Greenhow, Beth Robelia and John Hughes (2009) suggested that greater use of technology in schools would lead to increased participation and engagement by students (p. 277). For students who are motivated by the use of innovative tools, schools without significant integration of technology can be frustrating and unmotivating. For these kids, there ought to be a way to tap into the intrinsic motivation they have for learning through the use of digital tools.

While many teachers are interested with integrating innovation and digital tools in their curriculum, some do not have the experience or opportunity for professional development. According to Spires et al (2008), there are teachers who are trying to develop new and innovative ways to teach; however, they are working with students who are growing up with emergent technologies and adapting to them quickly and with ease (p. 498). This dilemma is pronounced as students are becoming more versed in the use of technologies and reliant on the opportunities provided by their use. Students are often early adopters of innovative technology and quickly

become adept in the use of these tools. One strategy teachers can use to capitalize on the skill of their students is to place them in the position of sharing their knowledge with others in the class.

By entrusting students with the role of conveyer of knowledge, teachers may need to relinquish some of their control and authority in the classroom and curriculum. While initially this may be a daunting and intimidating task, an opportunity for greater student motivation and learning is presented. In an research report in the *International Journal of Science Education*, author Sherry Hsi (2007) suggested that students want to take an active role in developing curriculum and designing learning opportunities—they have ideas about what they want to do with technology, in what settings they want to do it, and with whom they will best learn (p. 1525). Hsi (2007) noted that digitally fluent youth demonstrate and become more expert in a variety of practices including: a) building on their own skills and knowledge and that of others; b) spend free time working on technology-based skills; c) co-construct their social reality and establish norms for participation; d) take ownership of media creations and online expression; e) engage in two-way literacies in terms of production and consumption; f) demonstrate fluency by simultaneously operating and managing multiple devices; and g) work collaboratively on complex problems (p. 1514). While this researcher noted many benefits of the use of technology by digital kids, attention must also be paid to the world they live in and the risks that are associated with the use of digital tools.

In this 21st century, wired, digital world, students will continue to use technology on a regular basis, both in schools and in their lives outside of school. For educators concerned with both the benefits and risks of technology, they need to be prepared to help students make informed decisions about the use, and potential misuse, of digital tools. This need is particularly evident in the middle and high school years when students are apt to experiment with the use of different digital tools, yet do not understand the long term implications of misuse. As the media continues to report instances of cyber bullying, digital stalking, and identity theft, the need for education becomes more acute. Richardson (2009) suggested that if students live and will continue to live in a "hyper-connected and hyper transparent future, it is incumbent upon educators to teach kids how to use the digital tools safely, ethically, and responsibly (p. 8). Young people are using technology, particularly Web 2.0 applications, in every aspect of their lives—they are creative, interactive, and oriented toward digital media. A challenge facing

schools is how to address the digital disconnect that is occurring for students between their school lives and the time they spend out of school.

Students want schools to look more like the lives in which they live. As technology has transformed, our students have changed as well. For schools to continue to be relevant for students, we need to see a fundamental shift in their structure and purpose. Solomon and Schrum (2007) contended that while schools were once designed to prepare students with specific training or skills for a particular career, today's youth are no longer the people our system was designed to teach (p. 26). One particular distinction is in the use of digital tools and innovation. For many, students there is a disconnect between the presence of technology in their lives outside of school and a lack of presence and effective use in schools (Bosco, 2009, p.12). In this situation, students are forced to move between two cultures—their lives in school and the one they lead outside of school.

Section 2: Two Culture Issue

For some students, there is a marked distinction between the ways technology is used in their lives. Outside of school, students use technology in a way similar to how it is used in a professional career. In this setting, their use is constant—young people use technology in ways that enhance their social connections—ways that can be construed as authentic and personal. Spires et al (2008) suggested this notion is contrasted with schools and classrooms where students often find themselves "unplugged"—in some circumstances, students are not able to bring their digital tools into school or their classroom (p. 509). This distinction creates a quandary for educators—how to bridge the gap between the ways students live and learn.

In his seminal article, "Listen to the Natives", Prensky (2006) argued that students want to help invent the best designs for learning—not wait for others to do it for them. He advocates asking the students for their opinion—they have a vested interest in their education and will help school designers create learning environments that will be motivating and conducive for 21st century learning (p.10). The first step in creating this future school setting is to understand the nature of learning in out-of-school settings and how to enhance the systems of digital kids to provide for learning in schools and classrooms (Hsi, 2007, p. 1522).

In his article *Participatory culture and schools: can we get there from here*, researcher and professor emeritus James Bosco (2009) suggested that the dramatic rise and proliferation of Web 2.0 applications has created a two-culture problem as schools have not been able to capitalize on the presence and effective use of the applications for learning in schools (p. 12). (First coined in 2004 by Tim Reilly, the concept of Web 2.0 refers to a collection of applications that supports a participatory approach to information and knowledge.) The distinction in cultures is most evident in the participatory culture students are immersed in outside of school and the non-participatory culture they experience in school. MIT professor, Henry Jenkins, coined the term participatory culture to characterize the way the Web and other technologies has altered the way we look at knowledge, information, and the collaboration between learners (Bosco, 2009). According Lemke, et al (2009) in a report commissioned by the Consortium of School Networking (CoSN) this dicotomomy is a challenge for all constituents since at this point school cultures and educational mindsets may not align with learning in the twenty-first century (p. 5). In referencing the work by Jenkins, Bosco (2009) suggested that a participatory culture is characterized by the shift from a small number of producers of information and knowledge to one in which many of those who would have previously been consumers of information are also producers (p.12).

Other researchers are considering a different model for looking at the shifting roles between producers and consumers of information—a concept termed as a learning ecology. Brown (2000) first referenced the concept of a learning ecology as a place or situation where students are work collaboratively. In this setting there can be a hybridization of ideas—students working in a virtual online environment—sharing ideas and allowing for a cross-pollination of ideas between different individuals and groups (p. 19). Whether we consider the concept of a participatory culture or a learning ecology, it seems evident new digital technologies have made the concept of a learning revolution in education a possibility.

To maximize on the possibility of a learning revolution, Resnick (2008) suggested that we have to create a new model of thinking and learning—we cannot use technologies to merely reinforce an outdated approach that is no longer serve our students (p. 32). A majority of the schools our students presently attend were designed for 19th century learning. As we find ourselves well into the 21st century, we need to assess our schools and determine if significant changes need to be made. R. Keith Sawyer, editor of the *Cambridge Handbook of the Learning*

Sciences posed the question of whether "today's schools are really the right ones for a creative or knowledge society (2002, p. 568). As we look ahead to the learning goals of the 21st century, many would suggest that the answer is no…today's schools are not really the right ones for the children of the 21st century.

Section 3: Learning Design: Schools for the future of learning

As educators and researchers consider school design, they must keep in mind the future our students face. As we ask ourselves if today's schools are really the right ones for a knowledge based or creative society, we must consider the skills they need to be successful in the 21st century. In building skills necessary to meet learning goals, students must be provided opportunities to think creatively, build knowledge collaboratively, and work in teams to problem-solve. At this point in 2010, significant changes have not been made to our nation's schools or the traditional public school learning experience to meet the objectives of the Partnership for 21st century skills, a national organization that advocates for 21st century readiness for all students. As we move toward change and transformation of our schools, Sawyer (2002) suggested that classrooms of our future schools should allow students to be engaged in learning that is contextual in nature, based on authentic problems to solve (p. 577). This notion was supported by Bob Pearlman, an advocate for educational reform, who suggested that an effective learning environment is one that was in-depth and based on problem-based learning. In this environment, students would work in teams to gain critical thinking skills, communication skills, and would be provided authentic feedback (2006, p. 111).

When considering the ideal environment for 21st century learning, we need to consider how technology can support learning in a way that is based on sound research and trusted pedagogy. The schools that many reformers envision will offer a significantly different experience for students, providing an essential shift in the learning that can occur. If technology is going to be infused, it needs to be more than an add-on to existing curriculum and structures. This move will require a change in the way we view technology as a tool to support learning. According to Brown (2000), we need to consider the "shift between using technology to support an individual to using technology to support relationships between individuals" (p. 19).

Educational researcher Donna DeGennaro (2008) asserted that schools need to craft learning designs to capitalize on the technological practices of youth which include: a) tinkering with technology; b) working independently; c) working and learning with a variety of media; and d) collaborating with others (p. 1). This notion is supported by Australian researcher Nicola Carr who suggested that "emergent technologies have the potential to facilitate greater learning and knowledge building through increased participation and collaboration" (2008, p. 147). (Emergent technologies are those that are considered novel, innovative, or cutting edge). The potential of emergent technologies is congruent with what researchers are suggesting about our students—many are motivated by the ability to collaborate with others to build knowledge. Educators and reformers need to consider how to capitalize on the motivation and potential as they modify learning environments in response to shifting demands and needs of a global world.

A real challenge facing education is the need to create schools that meet the needs of today's students with an eye to the skills and knowledge needed as they matriculate and become workers in a global economy. Sawyer (2002) suggested that new schools need to be designed for a new future—one that is based on a knowledge-based economy that will rely on innovation (p. 567). In his article *Toward real digital learning*, professor and author Scott McLeod, (2009) asserted there is a real need to create learning environments that will adequately prepare students for the demands of the global, digital age (p. 29). In his popular video "Did you know 3.0", co-author McLeod posed the following:

> "Did you know the top 10 in demand jobs in 2010 did not exist in 2004?
> We are currently preparing students for jobs that don't yet exist, using technologies that haven't been invented, in order to solve problems that we don't even know are problems yet."

Richardson (2009) challenged educators to "have the vision required to see this world in a new light, one that aligns more closely with the reality our students are stepping into" (p. 10). If schools in the future are going to use more digital tools and technologies, a shift in the way we design our classroom environments and curriculum is essential.

As schools and districts consider the requirements of standards and benchmarks, technological tools can not be an add-on to an already overburdened curriculum. In an ideal scenario, technology is used to support critical, creative, and collaborative learning in authentic and real-world situations. This emphasis will present a significant shift in the paradigm of present curriculum and pedagogy. In considering classrooms and curriculum of the future,

McLeod (2009) suggested the "need to create curriculum that emphasizes the acquisition of 21st century skills rather than regurgitation of discrete facts and low-level procedural knowledge" (p. 29). Schools of the future are not technology schools; rather environments where technology learning in an authentic and applicable fashion. In this scenario, educators are challenged to consider how to use the tools to support learning and the goals of the school.

Through the proliferation of the Internet and mobile devices, it is evident that Web 2.0 has permeated the lives of our students. While some educators continue to fear the encroachment of yet another government or district mandate, it is clear that there are educational benefits from the implementation and use of innovative tools. In his article, *Toward Real Digital Learning,* McLeod (2009) suggested that "technology in schools should be like oxygen: ubiquitous, necessary and invisible" (p. 31).

Section 4: Emergent Technologies and Digital Tools

The Horizon Report is an annual publication describing the work of the Horizon Project which endeavors "to identify and describe emerging technologies that will likely have an effect on teaching, learning, and creative expression" (p. 3). The research group works to identify key trends that will have an impact on the technologies emerging over the next one to five years. One underlying concept is the increased globalization that will affect the way we work, collaborate and communicate (p. 5). There are a number of reasons to support the use of emergent technologies; however researchers Willcockson and Phelps (2010) pointed out the benefit of emerging technologies is the fact that they are more accessible, less expensive, and easier to learn—the challenge is to find effective, efficient ways to incorporate the tools into classrooms (p.1). In their article, *The use of Blogs, Wikis and RSS in Education: A Conversation of Possibilities*, authors Duffy and Bruns (2006) suggested that for those who are advocates of the use of emergent innovations, the technology allows for content creation, peer assessment, formative evaluation, and group reflection (np). While there are numerous digital tools and technologies available to school, Web 2.0 tools are having the most significant impact on teaching and learning in the 21st century.

Web 2.0

While the use of computers and technology have become commonplace in schools and businesses, student's lives have been permeated by a collection of digital tools and emergent technologies that did not exist a decade before. In addition to laptop computers and other mobile devices, there has been a transformation in the way people interact with online information. Earlier versions of the World Wide Web were based on applications, licensed software and copyrighted content; the newer version features opportunities for free open-source software and web-based collaboration (Solomon and Schrum, 2007, p. 23).

Students have embraced the changes in the Web as it allows a two-way flow of information—not only can you pull information from the web, anyone has the ability to push information for others to utilize. According to Brown (2000), the web provides a forum to support multiple intelligences which in turn can provide educators an appropriate medium to engage students in a way that is best suited for their learning (p. 12). From a diversity and equity point of view, the use of tools that support a variety of learning styles and preferences is beneficial for all learners.

From an educational perspective, North Carolina State University professors Anson and Miller-Cochran (2009) suggested that the use of Web 2.0 tools supports a participatory approach to students to actively and collaboratively build and share knowledge (p. 38). The continued use of Web 2.0 tools throughout a student's learning experience allows for an "interactive and participatory environment that helps to foster collaboration, communication, community, and student voice" (Lemke, et al, 2009, p. 5). From a short term perspective, there is a need for educators to realize the potential of creating and fostering a participatory environment. From the long term perspective, the use of Web 2.0 applications can help to establish school cultures that continuously promote and embrace innovations to advance deep, authentic learning. Where students once worked independently on projects and papers, they now have the opportunity to edit and share documents with others in the same classroom and around the world.

Although many of these tools are new and intimidating for educators who are not well versed in technology, it is evident that the tools will be a part of the lives of this generation for years to come. This notion provides an opportunity for educators to benefit from the innovation and allure of emergent technologies. While the use of these tools may be motivating for students, profound changes in education will only occur when they are used to deepen student learning

through authentic, real world learning (Lemke, et. al, 2009, p.6). It is helpful to consider the web as a platform—containing applications and technologies that allow for communication and connectedness.

There are numerous applications available to the general public; however, the most common tools found in educational settings include blogs, podcasts, wikis, social networking, photo sharing and editing, and video showcasing. The next sections will describe the four tools that are most commonly used: wikis, blogs, podcasts, and mobile devices.

Wikis

According to Duffy, (2006), a wiki is a group of web pages that allow users to add and edit content. They are desirable in an educational setting since they allow students to construct and exchange information in a collaborative fashion. Caverly and Ward (2008) suggested that wikis support a "social constructivist, epistemological stance, allowing knowledge to be collaboratively constructed among students" (p. 36). According to Solomon and Schrum (2007), students use wikis for group collaboration and problem solving, peer editing, and electronic portfolios (p. 58). Duffy (2006) noted that wikis offer the opportunity for learners to interact with the document over a period of time—allowing students and teachers to see all iterations of the document or tool, providing an opportunity to track changes and to determine contributions of each group member. An added benefit is the ability for learners to collaborate with others without regard to time or geography.

Blogs

A Web log or blog can best be described as an online journal or set of personal commentaries. Duffy (2006) noted that in its simplest form, a blog is a "website with dated entries, presented in reverse chronological order and published on the internet" (What is a Blog section, para. 1). In his book, *Blogs, wikis, podcasts, and other powerful web tools for classrooms,* Richardson (2006) referenced the work of learning specialists Fernette and Brock Eide's research who suggest that blogs can:

- Promote critical and analytical thinking
- Be a powerful promoter of creative, intuitive, and associational thinking
- Promote analytical thinking
- Be a powerful medium for increasing access and exposure to quality information

- Comines the best of solitary reflection and social interaction (p. 20).

Podcasts

Solomon and Schrum (2007) described podcasting "as a way to distribute multimedia files over the internet for playback on mobile devices and personal computers" (p. 57). For educators, there are many uses including the opportunity to record and playback audio of a class lesson, creating a campus radio station, creating a "pod tour" of a school campus, as well as a way for students to reflect or chronicle their own learning. The number of available commercial podcasts has increased exponentially so users have taken advantage of RSS feeds to subscribe to available podcasts and blogs.

Mobile Devices

Of all the tools and innovations available to students and educators, mobile phones and devices have the potential for the greatest impact on curriculum and schools. In the 2009 Horizon report, the authors suggested that mobiles were one of the two technologies on the first adoption horizon suggesting the likelihood of widespread and mainstream use within one to two years. While mobile devices are already prevalent on college and high school campuses, the proliferation of third-party applications and location awareness devices make it a tool that has greater potential to improve learning, productivity, and communication (Horizon Report, 2009, p. 4). A group of researchers from the Queensland University of Technology suggested that mobile learning offers greater flexibility for learning, allowing for a more personal and learner-centered experience (Cobcroft, Towers, Smith, and Bruns, 2006, np). In a report entitled *Pockets of potential: Using Mobile Technologies to Promote Children's Learning*, Shuler (2009), suggested that there were five opportunities for the use mobile technologies to enhance learning including:

- Encouragement of "anywhere, anytime learning"
- Ability to reach underserved children
- Improve 21st century social interactions
- Fit with learning environments
- Enable a personalized learning experience (p. 4)

The cell phone is an interesting example of the need for a bridge between the two cultures a digital child is forced to span—outside of school, the use of cell phones is ubiquitous while their use is often banned in schools. While schools are apt to adopt many digital tools to enhance learning, there is still a reluctance to allow the widespread use of mobile devices in schools. In order to reach the tipping point of use, we need to find new ways to use cell phones for productive learning. Many educators find the use of cell phones to be distracting while others are concerned about the phone's unfiltered access to the internet. This last point is an interesting one for schools who choose to filter internet content—how do you help students learn to use their digital tools safely, responsibly and ethically? While there is certainly cause for some concern among educators, it points to the need to make learning and school relevant for our digital kids.

Cloud Computing

In the Horizon Report (2009), researchers identified cloud computing as one of key trends for education. While many are not familiar with the term cloud computing, most people using this technology on a regular basis. In this scenario, data is stored in large data farms that are not housed on a particular campus or work site—both the program to run the application and the data is stored on an internet server, known as the cloud (Nevin, 2009, p. 35). One popular use of cloud computing is the concept of Google Docs or Google Apps Education. These applications are gaining popularity in schools for several reasons: cost, storage, and collaborative potential. At the present time, Google offers their services to schools at no charge—this is clearly attractive to schools and districts strapped for money who wish to offer their learners access to technology. In addition, there is no need for large on-site servers to store information—all the data is stored off site. The most attractive educational benefit is the collaborative aspect—student can have access to the information in real-time from any computer that has an internet connection. Author Roger Nevin (2009) suggested other benefits include: free software (which is automatically updated), auto saving of documents, and the ability to publish documents to a variety of sources (p. 36).

Section 5: 21st Century Learning: Creativity, Collaboration, and Digital Learning

As we find ourselves ten years into the 21st century, we continue to emphasize the need for 21st century skills to better prepare our students for the global workplace they are poised to enter. According to McLeod (2009), the major area of growth in the American economy is coming from what is termed the "creative class". Mitch Resnick, MIT professor and director of the Lifelong Kindergarten group at the MIT Media Lab, contended that in order to prepare for a more creative society, we need to reconsider our present approach to education and how we use educational technology (2008, p. 22). In order to be successful in our creative society, our graduates need to master skills that were once thought to be "soft skills".

According to McLeod (2009) students will need to be adept in: critical thinking, complex communication, collaborative problem solving, and other more abstract skills such as media fluency, adaptability, global awareness and synthesis of large-scale dispersed data (p. 29). In the framework of 21st century skills (2009) the authors suggested that in addition to the learning and innovative skills (p. 4), students should be literate in information literacy, media literacy, and ICT literacy (p. 5). Greenhow, et al (2009) suggested that graduating students are expected to have mastered a number of 21st century competencies that transform the future work that will be done—how it will be done and with whom it will be completed. These competencies include "creative and original multimedia work in complex project oriented teams in which the problems, tasks, payers, roles, and processes are in flux and often distributed across geographic and cultural distances" (p. 248).

Fortunately technologies are being developed to help our students prepare for the creative society; the challenge is that adults need to be willing to take similar risks to those we expect of our students. Resnick (2002) contented that technology is the new medium for learners to create, design and express—the ability to design and create provides enormous opportunity to have a beneficial learning experience (p. 33). A close relative to the creative society is the concept of a knowledge society. While there are subtle differences between the need for knowledge and creativity, both concepts have identified a void in our educational system. Resta and Laferrière (2007) suggested that the knowledge society has created a need for flexibility in learning with regard to time and space as well as a learning environment challenge to incorporate more authentic problem solving and knowledge building (p. 77).

Greenhow et al (2009) described ways in which the web has created a participatory culture to foster learning and creativity. The transformation of Web 1.0 to Web 2.0 has altered

the way educators and researchers consider learner participation and creative practices. Many of the Web 2.0 technologies allow learners to collaborate to create and share information and media—both locally and globally. From a creative perspective, Web 2.0 tools allow for creation and remixing of content—whether it is text, audio, video, visual images, etc. The third aspect that Greenhow et al (2009) describe is the interactivity of Web 2.0—the ability to blog, podcast, use wikis, and share other content (p. 249). There are numerous implications for educators who strive to make learning more personal, relevant, and collaborative. Through the use of creative outlets and tools, students have opportunity to manage a project from start to finish to potentially starting again. Resnick (2008) coined the concept of a creative learning spiral where people move through an iterative cycle of imagining, creating, playing, sharing, reflecting, and imagining again (p. 18).

As Web 2.0 tools are used in educational settings, it is vital that students are provided opportunities to engage in dialogue as they strive to build knowledge together. In their article, *Technology in support of collaborative learning*, Resta and Laferriere (2007) contended that the discourse that students are engaged in must be meaningful and relevant to the task or idea (p. 73). One important skill to teach students is to be active learners—there is no reason for students to be passive recipients of knowledge. If one objective of education is to teach students to be self-directed, lifelong learners, they need to be provided the opportunity to engage in the co-construction of knowledge. Anson and Miller-Cochran (2008) suggested the need for students to play an active role in the building of knowledge and competencies through a variety of activities including: problem solving, cooperative learning, and inquiry guided instruction (p. 40). Teachers play an important role in guiding students through their educational journey—particularly one that has an interdisciplinary, project-based approach. In this approach, students and teachers need to work collectively as the focus shifts from considering what *needs* to be known to *strategies* for learning the things one does not know.

One benefit of shared knowledge construction is the notion that what the group can gain is greater than the sum of the individual participants. Resta and Laferriere (2007) suggested that four factors are critical to group success: student engagement, teacher scaffolding, pedagogical strategies, and peer scaffolding (p. 74). While there are ways to develop the needed skills without the use of technology, researchers have suggested a connection between the use of technology and increased skills. According to Hsi (2007), computers and technology can be an activity

centered tool to support deep and meaningful learning (p. 1524). This notion is supported by Resta and Laferriere (2007) who suggested that many of the available tools support social interaction, cooperation, collaboration, and the opportunity for the shared building of knowledge (p. 65).

Section 6: Process and Decision Making

While there is no tried and true handbook for how to integrate emergent technologies into a learning design, leaders must consider several factors. First and foremost, any plan must be rooted or based on a school's mission and core values. As institutions of learning, the conversations should be centered on enhancing learning and not just about the technology that is being introduced (Richardson, 2009, p. 10). To that end, it is important that teachers see themselves as learners first and teachers second. Larson and Ribble (2009) asserted the need to create and implement a shared vision to integrate technology into all aspects of teaching and learning (p. 13). Zucker (2008) suggested seven helpful principles for implementers to consider:

- The transforming organization must have a compelling vision to provide to all stakeholders in order to make them participants in the process.
- The use of any digital tools should be aligned with the key goals educational goals.
- Begin small—it is helpful to introduce a few tools rather than too many at once.
- Learn from those with experience—reach out to organizations or others who have had success.
- Budget for the long-term use of technological tools.
- Expect to engage and challenge more students than without the use of technology,
- Be sure to persevere (p. 205).

To make the best decisions, it is important to consider form and function—the concept of what technologies to use and when to use them. Equally important is the concept of affordance—the right tool or technology for a particular use of learning goal. As school leaders assess form, function, and affordance, they will have a greater understanding of what tools and technologies are most appropriate for the learning environment. Solomon and Schrum (2007) suggested that leaders need to evaluate how the current infrastructure in a school would support an increase in tools or technologies as well as consider how any new tool would support learning (p. 120).

Although there are many educational benefits from the use of digital tools, it is clear that technology alone does not guarantee greater motivation, collaboration, or knowledge building. Therefore, it is incumbent upon educators to help students understand the potential of technology as a tool, to encourage its use, and consistently evaluate the effectiveness of the use of digital tools. Pearlman (2006) suggested that technology has the potential to bind collaborative learning and communication together as we create learning environments to simulate an authentic work environment for students in our schools (p. 111).

Section 7: Conclusion

As we continue on our quest to develop schools for the future, we need to revisit the main goal of education—to prepare our students to be productive and contributing members of a global society. As we continue to live in a flat world, constantly connected to others across the world, our schools need to produce graduates poised to enter the workplace.

While there may be disagreement on the need and use of computers and technology in education, there is widespread agreement that in order to prepare our students for a world they are poised to enter, they must have the opportunity to develop skills that are transferrable to a variety of settings. I believe that through the development of integral core skills, supported by the use of appropriate tools and technologies, our students will be better prepared to compete on a global level. If schools are designed to prepare students for the world beyond high school, one that expects technological competency, it follows that schools need to help students prepare by learning to use technology in a way that is appropriate, safe, and will prepare them to be successful contributors in their future endeavors.

The advent of computers and the proliferation of technological tools have had a profound influence on our students and the educational system in which they are immersed. Our students have grown up using technology in most aspects of their lives, innovations and technological improvements are constantly occurring, and higher education and the workplace is expecting adaptable skills and competencies of our graduates. This ever-changing landscape presents both challenges and opportunities for schools and districts.

From my perspective, I choose to see the changes that are occurring as opportunities. Over the past fifteen years, I have been involved with the use of technology both as teacher in the classroom and as a tool in my position as an administrator. I do not view technology as a

silver bullet or a panacea; rather as a tool to help achieve the goals of a curriculum or position. Over the past five years, I have attempted to share my experiences and knowledge with my colleagues, offering suggestions of ways that certain tools or applications could be used to enhance a student's experience. I am not advocating the use of technology as a stand-alone or as an add-on—that would not be pedagogically appropriate in all classroom settings. What I suggest to my colleagues is the consideration of how technology could support their existing learning objectives and goals.

As I move forward to 693 and my synthesis, I want to consider how I might extend the work of this project. After reflection, I may decide that I do not want to continue this topic—not because I don't truly believe in what I have written; rather there are other topics and issues that are of interest to me. Throughout this process, I have learned a great deal about how others view the use of technology to support learning—clearly there are differing but not necessarily competing views. I believe that computers and technology play an important role in learning and I will continue to be a staunch advocate for use both in and out of the classroom. This advocacy is based belief that school needs to be relevant to students, it needs to be congruent with their experiences and their future interests. I believe we can provide an experience that will enable them to be thoughtful, creative and prepared for the future—that is the best preparation we can provide.

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