

Learning with teenagers:
Differences between teenage students and teachers
using and learning to use digital technologies

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Abstract

The purpose of this pilot study is to discover similarities and differences in the use of and learning to use digital technologies between teenage students and their teachers. It also explores how digital technologies are changing younger generations' ways of thinking and learning. Forty-four 7th and 8th grade students were interviewed in eight focus groups. Fifty teachers responded to similar questions on a survey questionnaire. The findings challenge us to rethink what and how we teach.

Introduction

Digital technologies are changing the world and how we live in it in profound ways. Not only are these changes constant, they occur often, everywhere, and fast. Media access at home comes in many shapes and sizes, and when we're not home, we take our tools and access with us in the form of cell phones, media players, and mobile computers. Two interesting observations about these technologies are that they are extremely mobile and connected, and place an increasing amount of control in users' hands. This reminds of us of Marshall McLuhan's (1994) well-known metaphor that media are extensions of human beings' senses, bodies, and minds. The pervasiveness of technology seems to affect many societies as a whole (see e.g. [Bell & Dourish, 2007](#), [Fisch, 2006](#)) with the exception of schools.

The challenge in education is two-fold. On the one hand, schools need to figure out ways in which to teach with the technologies that are widely used among their students. Teaching with this technology does not just mean teaching knowledge and skills. It also means helping students become safe, responsible, and ethical users of the many digital tools that are available to them on a daily basis. The current hesitation to do so in the name of student safety and minimizing learning distractions is doing the opposite of what it is intending to do, namely improve learning ([van 't Hooft, 2007](#)).

A second challenge in education is establishing and implementing strategies that will help teachers develop the skills, knowledge, and confidence necessary to effectively integrate technology into their classroom practices (Cradler, Freeman, Cradler & McNabb, 2002). The creation of effective and meaningful learning activities is a process involving complex interactions between the medium, the learner, the content, and the

context (Jonassen, Peck, & Wilson, 1999). Classroom teachers coordinate all, and as such are integral to the successful efforts to enhance classroom practices (McLaughlin & Oberman, 1996). Learning effective use of educational technology is a complex process that requires “epistemological shifts” and challenges teaching practices (McLaughlin & Oberman, 1996). Recent research suggests that effective teacher learning takes place within the ambiguity and chaos that is the lived reality of teachers’ classroom experience. Part of that learning is to observe [what and how students learn with new technologies](#). Because of the rapid development of new media and technologies, teachers must become open-minded to alternative mental models of knowledge integration and appropriation which have already become a mainstay of younger generations.

Student Use of Technology

What are teenagers’ experiences with digital technologies? Listening to their voices provides context to our study. Here is one of them:

I have often wondered how my generation will be remembered and identified... I couldn’t think of anything that my generation would be known for, so I popped in my earphones, played a relaxing song on my iPod and Googled the answer while I texted my friend’s cell phone asking if he wanted to go to the new Wi-Fi Coffee house to get a raspberry mocha flavored soy latte. That’s when it hit me: my generation will be known for having an abundance of absurd latte flavors! In addition to 24 different flavor options for your coffee-like beverage, we seem to have developed an affinity towards digital media (Mike L.: [MacArthur Foundation, 2006](#))

The above quote is from one of the fourteen teenage winners in an essay contest conducted by Global Kids (<http://www.globalkids.org/>). Global Kids is funded by the John D. and Catherine T. MacArthur Foundation (<http://www.macfound.org/>), which “launched a five-year, \$50 million digital media and learning initiative to help determine how digital technologies are changing the way young people learn, play, socialize, and participate in civic life” (<http://www.digitallearning.macfound.org/>) in 2006. The other 13 teenagers’ essays can be found [here](#).

The voices expressed in these essays are part of a much larger picture. A survey done by the Pew Internet Project called “[Teens and technology: Youth are leading the transition to a fully wired and mobile nation](#)” (Lenhart, Madden, & Hitlin, 2005) provides the following data:

- 87% of U.S. teens aged 12-17 use the internet, the highest percentage among any of the age groups studied.
- 51% of teenage internet users say they go online on a daily basis.
- One out of every two teens who use the internet lives in a home with a broadband connection. Wired teens are more frequent users of instant messaging. And they are now more likely to play games online, make purchases, get news, and seek health information.
- 81% of teen internet users play games online.
- 76% get news online.

It is easy to imagine that the numbers have escalated in the past two years since this study was done. The study also showed that teens go online mostly at home, 74% teens as compared to 17% teens access Internet at school, although these are two places where

most teens ever have opportunities to go online. Similar research has also indicated that “Internet users ages 12-28 are more likely to IM, play online games, and create blogs while Internet users over age 28 (but younger than 70) are more likely to make travel reservations and bank online” ([Fox & Madden, 2005](#)).

With respect to school, an earlier study by PEW ([Levin & Arafah, 2002](#)) noted a widening gap between Internet savvy students and their schools. On the one hand, the Internet savvy students rely on the Internet to help them do homework and they think of Internet as their virtual textbooks, reference libraries, virtual study groups, and virtual guidance counselors. On the other hand, in their schools administrators set the tone for Internet use. Teachers, who vary widely in attitude, choose whether to use what’s available or not. The most typical uses of the Internet in schools are not engaging as there is a lack of quality access due to technology restrictions. Blocking and filtering software often raise barriers to legitimate educational uses, and teachers do not usually assign homework assignments that require the use of the Internet because not everyone has access to the Internet at home. In addition, a survey done by Norris, Sullivan, Poirot, and Soloway (2003) pointed out that the real cause for the lack of computer impact in schools is often no or very limited access and, as a result, very limited use.

Often ignored in this scenario are the ideas and opinions of students. Schools still have a lot to learn about children and technology if they are to be successful in using technology for teaching and learning in effective and meaningful ways. A research project in Minnesota has proven that student involvement can be very powerful and yield positive results ([Education Evolving, 2005](#)). Findings indicated that kids want to use technology for learning, and want more and more diverse access to digital tools *in school*.

While they want to learn the basic technology and research skills, students also reported that they wanted challenging, meaningful, and interactive instructional activities, and move beyond use of the Internet for the Internet's sake.

Theoretical Framework

Besides the existing context, our study is informed by works that emphasize that children are active agents for their own conceptual development (Bruner, 1972; Gardner, 1993; Piaget, 2000; Papert, 1996), that they benefit greatly from a social environment which helps to increase their readiness to learn (Vygotsky, 1978), and that they learn in both formal and informal environments (Lave & Wenger, 1991). One area of particular relevance to this study is research on *ubiquitous and pervasive technologies*. Pioneering educators have explored the use of such technology options with promising results for education. Researchers have found much greater use of Internet resources, a greater variety of representations being used to explore, create and communicate knowledge, and a much wider variety of visual representations, spreadsheets and databases, simulations, and exploratory environments among the students in ubiquitous computing environments ([Apple computer, 1995](#); [Bartels & Bartels, 2002](#); Danesh, Inkpen, Lau, Shu & Booth, 2001; [Honey & Henriquez, 2000](#); Silvernail & Lane, 2004; van 't Hooft & Swan, 2006; Zucker & McGhee, 2005). They have also found that learning is becoming more efficient and that students are becoming experts on particular topics ([Apple Computer, 1995](#); Norris & Soloway, 2004). Further, researchers have found that teachers are becoming more student-centered, more constructivist, and more flexible ([Apple Computer, 1995](#); Fung, Hennessy & O'Shea, 1998; [Honey & Henriquez, 2000](#); Norris & Soloway, 2004;

Ricci, 1999; Rockman, 2003; Tatar, Roschelle, Vahey & Penuel, 2003; Zucker & McGhee, 2005), and that lessons are becoming more project-oriented, inquiry-based, and group collaboration oriented when digital technologies are used ([Honey & Henriquez, 2000](#); Norris & Soloway, 2004; Russell, Bebell & Higgins, 2004; Ricci, 1999).

Studies on *multimedia learning* (Mayer 2001, 2005), *video and game-based learning* (Gee, 2001; Gibson, 2007; Prensky, 2001, 2006), and the *net-generation* ([Oblinger & Oblinger, 2005](#); Tapscott, 1998) have also guided this study. For instance, Prensky (2001), together with several other researchers, has suggested that there are cognitive differences between “digital natives” (the younger generation who grow up surrounded by various digital technologies) and “digital immigrants” (the adult generations). Prensky (2001, p. 52) observed ten cognitive style changes in what he called the “game generation,” which are: 1) Twitch speed vs. conventional speed, 2) Parallel processing vs. linear processing, 3) Graphics first vs. text first, 4) Random access vs. step-by-step, 5) Connected vs. standalone, 6) Active vs. passive, 7) Play vs. work, 8) Fantasy vs. reality, 9) Payoff vs. reality and 10) Technology-as-friend vs. technology-as-foe.

According to Prensky, the game generation is operating at faster-than-normal speeds and this ability has moved into a generation at large and at an early age. Further, the game generation is more comfortable with multitasking and random access to information, driven by graphics, fun, fantasy and quick payoff, and active and well-connected. Such changes present opportunities as well as challenges for teaching and learning. Some of the challenges for teachers include how to speed up the learning process while keeping sight of quality and goals; how to increase textual literacy, depth

of information and logical thinking; how to create experiences that allow students to link anywhere and experience things in any order yet still communicate sequential ideas and logically thinking; how to take advantage of parallel processing; and how to search for new ways to combine fantasy and reality to help younger generations learn.

All in all, as described above, there seems to be an increasing gap between teenagers and the adults who teach them with regards to technology use and learning how to use digital technologies, one focus of our investigation here. Our second focus is the reported difference in use between home and school, both among students and teachers. Third, we investigated how differences in use and learning how to use digital technologies means for teaching and learning.

The Pilot Study

The focal question we ask with the study is: “Has growing up digitally changed teenage students’ ways of thinking and learning as compared to older generations? If so, what does this mean for teaching and learning?” This broad question was broken down into several sub questions:

- What digital technologies do teenage students and their teachers use in their daily lives? What do they use them for?
- How do they learn about new technologies? How do they learn to use them? Who helps them? Why do they adopt them? Why do they abandon them?
- What is different about using technology in school (at work for teachers) as compared to using it outside school (work)? What is different about learning to use technology in school (at work) compared to outside of school (work)?

- Has growing up digitally changed teenage students' ways of thinking and learning? If so, what does this mean for teacher learning?

Forty-four 7th-8th grade students were interviewed in eight focus groups while fifty teachers responded to a survey questionnaire containing similar questions. The interviews were recorded, video-taped, and transcribed. Three researchers independently coded the interview transcripts and survey results to look for emerging themes, compared, corroborated, and discussed analyses, and agreed upon the findings (Janesick, 1994, Lincoln & Guba, 1985).

Findings

Our data present similar patterns of use for teenage students and adult teachers as compared to the data from the PEW Internet Project studies (Lenhart, Madden, & Hitlin, 2005; Lenhart, 2007; Maden, 2005). We divided our findings into four broad areas: 1) Technology use in daily lives; 2) Learning to use technology: Learning habits and styles; 3) Knowledge download and transfer; and 4) Life and school. Each of these areas are explained below.

Technology use in daily lives

Our data show that both teenagers and teachers use a variety of technologies in their daily lives. However, they use them differently. Similar to the PEW study, we found that teenagers use various handheld technologies (laptop, cell phone, iPod, mobile gaming devices) and engage mostly in activities such as games, media creation and sharing, and online social networking. They prefer to read on *screen* rather than read on

paper and prefer *visuals* over written texts. Teachers, on the other hand, reported that the technologies they use most are computers and the Internet, TV, and digital cameras. When they are on the computer, they engage mostly in online banking and shopping. They prefer to have everything in one place and prefer to read on *paper* and read *written texts*.

Time presents itself as an important factor: teens engage in time expansion, while teachers use technologies primarily for time conservation. That is, teenagers are often in a time filling mode – they lose track of time, especially when gaming or communicating online. Teachers however, are constantly worried about time and frequently feel the pressure of being constrained.

Learning to Use Technology

Teenagers and teachers have different habits and styles when it comes to how they learn about and learn to use digital technologies. Most teenagers reported learning on their own, and when they have questions, they recursively use technology to ask friends or store salespeople. For teenagers, learning often equates to playing, and learning to use a new digital tool occurs in the process of reaching related goals (winning games, podcasting, etc.). For example, learning how to use an xBox follows the same process as learning how to win a particular game using the same console.

The design of new technologies and creation of support materials reinforces this style of learning. As a result, teenage students are often not concerned about all the details or a particular sequence of steps to be followed when trying out a new technology. They explore different features through trial and error in order to win a game as quickly

as possible, including “cheats” and code books. They do not easily tire of spending (or “filling”) time exploring and experimenting with new technologies and various features. Often, they share with others online through chat and SMS, or by posting what they’ve learned to bulletin boards and discussion forums.

Furthermore, teenagers do not usually have a pre-assumed notion of what a particular technology should do, thereby not being constrained by the “designed” functionality of a particular technology (e.g., cell phones may be used more for playing music or games rather than making phone calls). Teenagers want things fast, quick, easy and within reach, and they see technologies and the Internet as a means to help achieve these goals.

In comparison, teachers learn to use technologies through multiple channels, some on their own, others take workshops, and some ask friends. When teachers talk about learning by themselves, they usually indicate reading the manual before trying out a new technology, and they seldom have time to learn through long-term trial and error. In addition, teacher learning with technology presents itself as hard work and as a rather difficult learning process. For them, learning to use a new technology usually means to learn something separate from the task at hand, for instance learning to use Microsoft Word in order to do one’s job, before actually using it in a work-related setting. Teachers often see learning a new technology as required, additional work, something extra that is necessary (but not necessarily useful) to keep up with the times and their students.

Knowledge Download and Transfer

Different learning habits and styles result in differences between students and teachers in technical knowledge, skills, and capacities in transferring technical skills. Because teenagers learn to use technology in the process of reaching related goals and explore various features and functions of new tools without preconceived notions, their learning tends to be deeper and wider. Most teens have also acquired the ability to transfer technical knowledge and expertise to similar digital tools, a capability not readily apparent in most adults. Many teens simply jump in, explore, and figure things out as they go. We call this “appropriated convention” and it is based on the learners’ conditioned experiences and expectations formulated when interacting with multiple instances of different pieces of software or hardware.

An example is Luke (pseudonym), a 13-year-old boy. He has an appropriated convention in his head about cell phones because he has played with cell phones for a while; he has similarly acquired conventions about using video game controllers and TV and DVD remote controls. When Luke encounters a new but similar tool such as a PSP (PlayStation®Portable), he applies his past experiences with remote controls, games, and cell phones to his mastering of the PSP. After several rounds of trial and error, Luke has quickly become familiar with its major features and capabilities and may even be able to use the PSP in unintended ways. He quickly discovers areas of conventional overlap and becomes alert to specific design functionality and uniqueness that makes this device a PSP. While he may not know exactly why it is there, through repeated use of the technology he will attribute that uniqueness only to the PSP until his repetitive use of the product allows him to understand its limits or another product is introduced with similar

or overlapping capabilities. By this time he has characterized the new functionality and now knows what to expect from it. This experience becomes a new convention which can be used heuristically and/or constructively in a future encounter with a different tool.

Teachers, however, rarely have the luxury to explore a particular technology in depth. They usually learn a technology well enough to address a current problem before moving on to the next problem. Their learning, while focused and goal oriented, is also isolated and scattered. For them, technology remains an external tool, and deadline driven teachers often frame this single engagement as, *“It can either help solve the problem or take time away from solving the problem.”* Older teachers rarely see their acquisition of a particular software skill or technology as part of a larger integrated continuum, but rather as an add-on. Therefore, their purposely bounded knowledge of a particular technology is difficult to transfer to learning a new technology, and every exposure to a new technology is an entirely new learning experience, seemingly isolated and disconnected from their other obligations in life. Teachers remain focused on content and context while their younger students revel in explored functionality.

Life and School – The Issue of Control

An additional issue that emerged was one of control. Both teenagers and teachers seem to enjoy the freedom they have when learning new technologies in their daily lives. However, when it comes to school (or work), students and teachers indicated constraints.

With regards to technology use the findings highlight a gap between student uses of technology in school and outside of school. Teenagers in the focus groups complained that in school their use of technology is boring and restricted, and they have little or no

control over what they can use and how they can use it. Teenagers attribute this to rules and constraints in school, while at home they can learn more freely by searching for information in which they are interested, and use a variety of digital tools when the need arises. Students repeatedly voiced frustrations over universally blocked (yet safe) Internet content and a lack of access to existing equipment. They also commented that adults often make poor or limited decisions based on their previous K-12 experiences and what they think kids need (often ignoring student voices), and indicated that they would like more involvement in decision making with regards to their use of technologies in school. This cognitive dissonance emerged primarily as the result of two highly divergent experiences of their use of technology at school and at home.

Similarly, our data indicate that teachers are active users of digital technologies in their daily lives. However, when they go to school, they put themselves in a completely different world – a world where they often shy away from technology because of a lack of access or opportunities to integrate digital tools in the classroom, and isolation from peer input and collaboration. In many places, teachers are expected to teach to state and federal standards while dealing with a growing population of technology-savvy students who want and need more than the basics. Teachers admit they have little collegial or peer support because the culture and networks inside educational institutions do not support constructive collaboration. In an overloaded schedule consisting of teaching, administrative work, and other duties, there remains little time or opportunity to discuss innovative approaches as many schools continue to focus on memorizing content and downplay institutional and communicative process knowledge. Teachers actually often prefer the more traditional approach as it is one way to regain some measure of control

over their limited time. Yet as a result, the isolated teacher is strapped for time and gets little to no time for exploring technology.

The digital technologies that teenage students enjoy in their daily lives -- cell phones, PDAs, game consoles (for home use and portable), digital cameras, laptops, and iPods -- all put control directly in the hands of the user. Each of these devices has at least two things in common: 1) they give the user more *personalized* control, and 2) further shape a “*me-centric*” universe for the user. Therefore, teenagers not only have more innate control over digital tools, they also have the ability to customize their features for their own intended uses. While these learners are seen as process and practice experts in the use of many of the newer technologies, their skills have little connection to the standard content knowledge they are supposed to acquire in schools. Therefore, it is easy to see why students become de-motivated when they are supposed to learn in an environment that takes away personal control and imposes learning from above, often using outdated or severely restricted technologies. As greater functionality continues to be squeezed into a single mobile digital device at cheaper prices, younger generations will have greater control at even younger ages. Unless schools face up to this challenge, this gap between teacher and learner will continue to widen.

Conclusions and Implications for Teaching

The current global technology knowledge base doubles every 18 months, and is expected to double every 72 hours by 2010. For a student who enrolls in a traditional four-year college or tech school this year, half of the knowledge he/she studies in his first year will be outdated by the end of the third year (Fisch, 2006; [Kurzweil, 2001](#)). With

this exponential rate of growth it is easy to see that our relationship to information, knowledge, and technology is constantly changing. The nature of this information is also changing as it is increasingly networked, unlimited, fluid, multimodal, and overwhelming in quantity. Digital technologies such as cell phones, wireless handheld devices, and the Internet provide access to a wide range of resources and tools, anywhere and anytime, and therefore greatly increase opportunities to learn outside institutionalized school systems (Cross, 2006, [Sefton-Green, 2004](#)).

While society as a whole adjusts to these constant changes, schools are lagging behind. Learning needs to shift from memorizing foundational content to skills that are more in line with the 21st century, skills centered on finding and acquiring information in various contexts, evaluating, aggregating, and synthesizing that information, critical thinking, problem solving, creating new knowledge, and sharing and communicating. Given the ever-growing amount of information available, being able to find and choose credible and appropriate knowledge sources is essential. In other words, students should acquire skills that allow them to be flexible across different contexts in space and time; much of the current schooling is not preparing them for that. Learning should be seen as a lifelong process whereby individuals acquire information, values, skills, and knowledge from social interactions, work, play, exercise, and media, not as something that is static and only happens in school (Lave & Wenger, 1991; McGivney, 1999; [Sefton-Green, 2004](#)).

Our data shows that currently there is a vast and widening schism between teachers and the learners. While most young learners are rapidly learning how to appropriate, adapt, and apply techno-knowledge in their personal lives, schools and

teachers are not keeping pace with this growth. Teaching and learning should shift from merely memorizing content to acquiring higher-level thinking skills that are needed to enter the 21st century workforce. In addition, schools need to make more of an effort to teach with and about technology that will help students access and manipulate information, and allow them to communicate and collaborate with others. The technology will bypass even the most well-intentioned teachers if they remain transfixed in isolated and ill-equipped locations; in fact, in many cases it already is. If schools focus solely on learning content, standards, and high stakes testing, with little or no emphasis on the learning platforms or the expanding “me-centric” universe of the learners, teachers will be effectively worked around and ignored.

In sum, we need to fundamentally reconsider how teachers teach and students learn. We need to think about how the *curriculum* needs to change to prepare students with 21st century knowledge and skills, using 21st century tools and assessments. Second, we need to reflect on *pedagogy*, shifting from a focus to teaching to a focus on learning. Third, we need to rethink boundaries, as various technologies enable learning across space and time, removing boundaries imposed by brick and mortar spaces and the school day.

An ongoing challenge in education is establishing and implementing strategies that will help teachers develop the skills, knowledge, and confidence necessary to effectively integrate technology into their classroom practices (Cradler, Freeman, Cradler & McNabb, 2002). The creation of effective learning activities is a process involving complex interactions between the medium, the learner, the content, and the context (Jonassen, Peck, & Wilson, 1999). Classroom teachers coordinate all, and as such are

integral to the successful efforts to enhance classroom practices (McLaughlin, 1996). Learning effective use of educational technology is a complex process that requires “epistemological shifts” and challenges teaching practices (McLaughlin, 1996). Recent research suggests that effective teacher learning takes place within the ambiguity and chaos that is the lived reality of teachers’ classroom experience. Part of that learning is to observe what and how students learn with new technologies. Because of the rapid development of new media and technologies, teachers must become open-minded to alternative mental models of knowledge integration and appropriation which have already become a mainstay of younger generations.

Based on the findings in this pilot study we suggest that teachers consider the following five options as they decide to change or improve their teaching practices:

- Knowing and understanding teenage students...knowing what they are doing is often closely related to understanding new technologies;
- Giving students more control – Involving and guiding students in decision making processes;
- Bringing student expertise into teaching and learning processes;
- Making connections between life and school...both students and teachers are painfully aware of the gaps in technology use between their daily lives and their schoolwork;
- Recognizing paradigm shifts when they occur...we recognize that while the world lies at the teenagers’ fingertips, they still need to be educated how to function in and navigate this world (both real and virtual) in safe, ethical, and responsible ways.

The rate of technological change is so fast that young learners must adopt a different assimilation paradigm to be able to make sense of the tidal wave of information that is thrown at them on a daily basis. The “digital natives” seem to intuitively know the need for such ability even though it is not formally taught. The new generation's ways of learning are greatly influenced by the rapid change in technologies as it experiences the process of playing with games, communicating with cell phones, and creating and sharing media at the click of a mouse. If teachers and adults continue to try to enforce how they think kids *should* learn based on their own K-12 experiences, they are in fact promoting ways of "learning" that slow down the learning process. Education should actively involve both teachers and learners, as it is a process that “won’t make much difference if we don’t teach them how to learn first. And they do that not by spitting back at us what they “know”. They do it by being creative, by trying and failing, by succeeding and reflecting” ([Richardson, 2006](#)).

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