DO GENERATIONAL DIFFERENCES MATTER IN INSTRUCTIONAL DESIGN?*

PROFESSOR THOMAS C. REEVES

The University of Georgia

Department of Educational Psychology and Instructional Technology (EPIT)
604 Aderhold Hall, Athens, GA 30602-7144 USA
tel - 706-542-3849 / email - treeves@uga.edu / url - http://it.coe.uga.edu/~treeves/

INTRODUCTION

In the Spring of 2006, I conducted a literature review with my graduate research assistant, Ms. Eunjung Oh, to address questions related to generational differences in the contemporary workforce that might justify the specification of a new instructional design model and/or the development of innovative instructional methods and technologies to accommodate the generational differences found to exist. The final version of the literature review was submitted to the U.S. Department of Labor and UPS in the summer of 2006. After submitting the review, we continued to review the literature, and an updated version (Reeves & Oh, 2007) appears in the recently released third edition of the *Handbook of Research on Educational Communications and Technology* (Spector, Merrill, van Merriënboer, & Driscoll, 2007). The literature review presented in this paper is intentionally more provocative than earlier versions in hopes of sparking a lively debate on ITForum in January 2008.

The following questions are addressed in this paper:
- What chronological schemes are used to distinguish among the various generations (e.g., Baby Boomers, Generation X, and the Net Generation) in today's workplace?
- What is known about the differences among the generations with respect to values, work habits, and motivators in the workplace?
- What is known about differences among the generations in today's workplace across gender, race, and socioeconomic status?
- What is known about the differences in technology skills and information literacy among Baby Boomers, Generation X, and the Net Generation?
- What is known about the preferences for different approaches to training among Baby Boomers, Generation X, and the Net Generation?
- What evidence can be found for the differential efficacy of various pedagogical approaches (instructional models) for educating, training, and supporting the performance of workers belonging to Generation X and the Net Generation?
- What evidence can be found for the differential efficacy of various learning technologies for educating, training, and supporting the performance of workers belonging to Generation X and the Net Generation?

DISTINGUISHING THE GENERATIONS

Generational differences are widely discussed in the popular press and business-oriented books. For example, in the past year alone, three new books focused on generational differences appeared: *Bridging the Generation Gap: How to Get Radio Babies, Boomers, Gen Xers, and Gen Yers to Work Together and Achieve More* (Gravett & Throckmorton, 2007); *Motivating the "What's In It For Me" Workforce: Manage Across the Generational Divide and Increase Profits* (Marston, 2007), and *The Generational Imperative: Understanding Generational Differences in the Workplace, Marketplace, and Living Room* (Underwood, 2007).

The nomenclature used to label the generations is not standardized because the various people writing about generational differences have come up with a variety of different names to label the various generations. There is also significant disagreement among the various authors about which span of years should be encompassed within any one generation. Figure 1 shows a comparison of

the different labels given to various generations as well as the different chronological schemes used to assign people born in any given year to a generation as defined by the sources listed column one.

Howe & Strauss, 1991	Silent Generation	Boom Generation	13th Generation	Millennial Generation	
	1925-1943	1943-1960	1961-1981	1982-2000	
Lancaster & Stillman, 2002	Traditionalists	Baby Boomers	Generation Xers	- Millennial Generation - Echo Boomer - Generation Y - Baby Busters - Generation Next	
	1900-1945	1946-1964	1965-1980	1981-1999	
Martin & Tulgan, 2002	Silent Generation	Baby Boomers	Generation X	Millennials	
	1925-1942	1946-1960	1965-1977	1978-2000	
Oblinger & Oblinger 2005	Matures	Baby Boomers	Gen-Xers	- Gen-Y - NetGen - Millennials	Post-Millennials
	<1946	1947-1964	1965-1980	1981-1995	1995-Present
Tapscott, 1998		Baby Boom Generation	Generation X	Digital Generation	
		1946-1964	1965-1975	1976-2000	
Zemke, Raines, & Filipczak, 1999	Veterans	Baby Boomers	Gen-Xers	Nexters	
	1922-1943	1943-1960	1960-1980	1980-1999	

Figure 1. Generational labels and dates reported in different sources.

The focus of this review is on the three middle generations (Boomer, X, and Net Gen) because members of these generations will dominate the workforce over the next 5-15 years. However, it is important to acknowledge that there is a great deal of variance among the distinguishing characteristics within any given generation, and thus it is unjustified to assume that if a person was born in 1985, he/she would have most of the characteristics of Gen Y, or that someone born in 1960, and thus a late Boomer, would be not as technologically sophisticated as a person born into Gen X or Gen Y.

Lancaster and Stillman (2002), among others, have made a distinction about people born on the edges of various generational spans or caught between two generations by labeling them "cuspers." Lancaster and Stillman (2002) maintain that the Traditionalist/ Baby Boom cuspers were born between 1940 and 1945. Baby Boom/Generation X cuspers were born between 1960 and 1965 and the Generation X/Millennial cuspers were born between 1975 and 1980. The existence of cuspers further limits the generalization of generational traits to individuals based on their categorization with regard to generation.

VALUES, HABITS, AND MOTIVATORS

Birth years are only one factor to consider in distinguishing among generations, and a relatively minor one at that. Instead, most experts argue that generations are shaped much more by history than by chronological dates. According to Howe and Strauss (2000), three attributes that more clearly identify the nature of a generation than years of birth are:

- **Perceived membership**: The self-perception of membership within a generation that begins during adolescence and coalesces during young adulthood.
- **Common beliefs and behaviors**: The attitudes (toward family, career, personal life, politics, religion, etc.) and behaviors (choices made in regard to jobs, marriage, children, health, crime, sex, drugs, etc.) that characterize a generation.
- **Common location in history**: The turning points in historical trends (e.g., from liberal to conservative politics) and significant events (e.g., the Vietnam War) that occur during a generation's formative years (adolescence and young adulthood).

Many of the theories and conclusions about generation differences reported in popular books such as those written by Howe and Strauss (2000) are based upon survey data collected from young people from middle and upper middle socioeconomic groups. No national surveys related to generational differences that cut across the full range of socioeconomic status (SES) groups in the USA can be found in the literature. In addition, the majority of the published sources are focused on people who will enter colleges and universities and eventually pursue "white collar," "knowledge worker," or "professional" careers. Virtually no literature can be found that specifically addresses the generational differences among those who will not enter higher education or who are more likely to assume "blue collar" or service industry jobs. Needless to say, this is a severe limitation.

For example, a survey conducted by Universum Communications involved 37,000 "soon-to-graduate college students of the millennial generation" from 207 colleges and universities in the USA (Stone, 2006, p. 1). According to this survey conducted in the spring of 2006, the career goals of today's Net Gen college graduates are "to balance their personal and professional life (59 percent), pursue further education (46 percent), build a sound financial base (32 percent) and contribute to society (27 percent)." Whether these types of career ambitions would surface among workers without college educations in the same Millennial cohort has not been addressed.

The most frequently cited sources for issues related to generational differences are the works of Neil Howe and William Strauss, authors of several series of popular books such as *Generations: The History of America's Future, 1584 to 2069*; *13th Gen: Abort, Retry, Ignore, Fail?*; *The Fourth Turning*; *Millennials Rising: The Next Great Generation*; *Millennials Go to College: Strategies for a New Generation on Campus*; and most recently, *Millennials and the Pop Culture*. Their most controversial projection is that the Millennial Generation (also known) as Generation Y, the Net Generation, and by other names,

will be the most successful generation since the so-called "Greatest Generation" that fought World War II. For example, in their best-selling book, *Millennials Rising*, Howe and Strauss (2000) predict a rosy future for Generation Y:

> As a group, Millennials are unlike any other youth generation in living memory. They are more numerous, more affluent, better educated, and more ethnically diverse. More important, they are beginning to manifest a wide array of positive social habits that older Americans no longer associate with youth, including a new focus on teamwork, achievement, modesty, and good conduct. (p. 4)

Secondary sources such as Forrester Research, an independent technology and market research company, have extrapolated from Howe and Strauss and other pollsters to make optimistic conjectures about the work habits of Generation Y:

> The "Millennials" — born between 1980 and 2000 — have an innate ability to use technology, are comfortable multitasking while using a diverse range of digital media, and literally demand interactivity as they construct knowledge. Millennials lack the workaholic drive of their burned-out predecessors, but they compensate by using many technologies — often simultaneously — to get the job done quickly and have a personal life as well. (Schooley, 2005, Executive Summary)

Of course, some critics take issue with such optimistic predictions, especially with the generalizations made from limited survey data by Howe and Strauss. For example, David Brooks (2000), a reviewer for the *New York Times*, wrote:

> Now if you're going to get through this book, you can't hurl it against the wall every time Howe and Strauss make a huge generalization about an entire age category, because you'll either knock down your house or tear your rotator cuff. This is not a good book, if by good you mean the kind of book in which the authors have rigorously sifted the evidence and carefully supported their assertions with data. But it is a very good bad book. It's stuffed with interesting nuggets. It's brightly written. And if you get away from the generational mumbo jumbo, it illuminates changes that really do seem to be taking place.

O'Neill (2000) presents another typical criticism aimed at Howe and Strauss:

> This latest book, like the others, mixes statistics from responsible data-collectors such as the Institute for Social Research with results from scientifically unrepresentative surveys of 200 high schoolers in Virginia and from postings on their websites (www.millennialsrising.com and www.fourthturning.com).

Twenge (2006), in her research-based book titled *Generation Me: Why Today's Young Americans are more Confident, Assertive, Entitled -- and More Miserable than ever Before*, also criticizes the optimistic conclusions drawn by Howe and Strauss:

> My perspective on today's young generations differs from that of Neil Howe and William Strauss, who argue in their 2000 book, *Millennials Rising*, that those born since 1982 will usher in a return to duty, civic responsibility, and teamwork. Their book is subtitled The Next Great Generation and contends that today's young people will resemble the generation who won World War II. I agree that in an all-encompassing crisis today's young people would likely rise to the occasion – people usually do what needs to be done. But I see no evidence that today's young people feel much attachment to duty or to group cohesion. Instead, as you'll see in the following pages, young people have been consistently taught to put their own needs first and to focus on feeling good about themselves. This is not an attitude conducive to following social rules or favoring the group's needs over the individual's…Our childhood of constant praise, self-esteem boosting, and unrealistic expectations did not prepare us for an increasingly competitive

workplace and the economic squeeze created by sky-high housing costs and rapidly accelerating health care costs. After a childhood of buoyancy, GenMe is working harder to get less.

Criticisms have also been made about the books written by other proponents of theories about generational differences. In a review of *When Generations Collide* by Lancaster and Stillman (2002), Blohowiak (2002) wrote:

> In an attempt to provide statistical data on generational differences, the authors point to results from an online survey they conducted. You don't have to be a career researcher or social scientist to recognize that such surveys are comprised of small, nonrandom, non-representative and therefore invalid samples. That is especially true when extrapolating tiny slivers of data to reach conclusions about an entire generation representing tens of millions of people!

Indeed, it is difficult to find the details about the surveys upon which most popular generational books are based. Even when the scant information provided is found, there is an almost complete lack of consideration for factors such as reliability and validity. To their credit, Howe and Strauss (2000) do provide information about their surveys at: http://www.millennialsrising.com/. They report that a total of 202 teachers and 655 students from the class of 2000 completed the surveys upon which their book is based. Some critics have suggested that the fact that all the surveys were conducted in Fairfax County, Virginia, an affluent suburban area just outside Washington, DC, limits the generalizability of the optimistic conclusions Howe and Strauss have drawn to less affluent areas of the country. Howe and Strauss defend their results as follows:

> Comprising the western suburbs of Washington, D.C., Fairfax County (with a total population of one million, including 170,000 school-age kids) has one of the largest and most renowned school systems in the nation. Its student population is ethnically diverse—67 percent Caucasian, 13 percent Asian, 10 percent Hispanic, 8 percent African-American, and 3 percent other. Three of every ten students live in homes where a language other than English is spoken. Though Fairfax County is relatively well-to-do, with a median household income nearly twice the national average, eighteen percent of all students are eligible for free or reduced-price school lunches, nine percent live in households with annual incomes under $25,000, and five percent live beneath the official poverty line.

While Howe and Strauss focused on high school students, others have focused on higher education students. Diana G. Oblinger, former Executive Director of Higher Education for Microsoft and now President of EDUCAUSE, a nonprofit organization focused on improving the application of information technology in higher education, and James L. Oblinger, Chancellor of North Carolina State University, co-edited a book titled *Educating the Net Gen* (2005) (http://www.educause.edu/educatingthenetgen). The contributors to this book argue that the current generation of students entering higher education has information technology skills that exceed those of the faculty members who will be teaching them, a trend that demands significant changes in the way that programs, course, and learning environments are designed and implemented. However, Oblinger and Oblinger (2005) issue the caveat that the technological sophistication of today's Net Gen students may be somewhat superficial:

> Having grown up with widespread access to technology, the New Gen is able to intuitively use a variety of IT devices and navigate the Internet. Although they are comfortable using technology without an instruction manual, their understanding of the technology or source quality may be shallow. (p. 2.5)

Another researcher focused on generation differences among college students, Debard (2004), summarizes the values of Boomers, Gen Xers, and Gen Yers that he thinks have implications for higher education administrators and faculty (see Figure 2).

Views Toward	Boomers	Gen Xers	Millennials
1. Level of trust	Confident of self, not authority	Low toward authority	High toward authority
2. Loyalty to institutions	Cynical	Considered naive	Committed
3. Most admire	Taking charge	Creating enterprise	Following a hero of integrity
4. Career goals	Build a stellar career	Build a portable career	Build parallel careers
5. Rewards	Title and corner office	Freedom not to do	Meaningful work
6. Parent-child involvement	Receding	Distant	Intruding
7. Having children	Controlled	Doubtful	Definite
8. Family life	Indulged as children	Alienated as children	Protected as children
9. Education	Freedom of Expression	Pragmatic	Structure of accountability
10. Evaluation	Once a year with documentation	"Sorry, but how am I doing?"	Feedback whenever I want it
11. Political orientation	Attack oppression	Apathetic, individual	Crave community
12. The big question	What does it mean?	Does it work?	How do we build it?

Figure 2. Generational differences on 12 criteria (Debard, 2004).

Using a much more rigorous approach to generational research than other generational researchers, Twenge (2006) presents convincing evidence that most of today's American young people (which she labels Generation Me or GenMe) have been raised to think that they will be highly successful, even stars, although the reality is that they will find it harder than ever to get into and afford the best colleges, find a high-paying, personally-rewarding job, and buy a decent home. Whereas most other generational researchers have taken a cross-sectional approach to their research wherein they distributed surveys to or conducted interviews with members of different generations at the same point in time, Twenge (2006) has painstakingly analyzed the results of studies that involved school children, adolescents, and college students completing well-designed, validated questionnaires in the 1950s, 60s, 70s, 80s, 90s, and today. This enabled her to compare, for example, the attitudes of the Baby Boomer generation expressed when they were adolescents with the attitudes of GenMe expressed during their adolescence. A sample of her findings derived from data collected from 1.3 million young Americans since the 1950s include:

- In 2002, 74% of high school students admitted to cheating whereas in 1969 only 34% admitted such a failing. (p. 27)

- In 1967, 86% of incoming college students said that "developing a meaningful philosophy of life" was an essential life goal whereas in 2004 only 42% of GenMe freshmen agreed. (p. 48)
- In 2004, 48% of American college freshmen reported earning an A average in high school whereas in 1968 only 18% of freshmen reported being an A student in high school. (p. 63)
- In the 1950s, only 12% of young teens agreed with the statement "I am an important person" whereas by the late 1980s, 80% claimed they were important.
- In the 1960s, 42% of high school students expected to work in professional jobs whereas in the late 1990s, 70% of high schools expected to work as a professional. (p. 78)
- In a recent poll 53% of GenMe mothers agreed with the statement that a person's main responsibility is to themselves and their children rather than making the world a better places whereas only 28% of Boomer mothers agreed.

It is important to remember that the data from any kind of survey are based on self-reports rather than behavioral observations or other measures. Predictions made on the basic of surveys are tenuous as best. Speaking about what would become known as the Baby Boomer generation in 1959, Clark Kerr, President of the University of California at Berkeley said: "…employers are going to love this generation …They are going to be easy to handle. There aren't going to be any riots" (quoted in Manchester, 1974). Kerr's naïve optimism about the Baby Boomers illustrates the danger of predicting the behavior of future generations. Many members of the Baby Boomer generation protested, and even occasionally rioted, about civil rights, the Vietnam War, feminism, and the environment (Gillon, 2004). The optimistic predictions made about Millennials by Howe and Strauss (2000) and others may be just as mistaken as Kerr's errant prophecy.

GENERATIONAL DIFFERENCES ACROSS GENDER, RACE, & SES

Much more research has been reported about generational differences in relationship to gender than to race or socioeconomic status (SES). For example, Shelton and Shelton (2005) conducted surveys of 1,200 Generation X women in the workplace. Their survey results indicated that the majority of these Gen X women had expected to inherit the equal opportunities supposedly won by their Baby Boomer "feminist" mothers, but instead they felt that they are still encountering many of the same barriers that they perceived as keeping women out of the leadership and management roles still assumed primarily by men. Shelton and Shelton (2005) concluded that a significant number of Generation X women were leaving the workforce or lowering their expectations for career advancement in light of the barriers they perceived. The same survey found that positive relationships with colleagues, interesting work, and continuous opportunities for learning were listed as the top three workplace attractors for Generation X women whereas recognition, power and prestige, and salary were ranked near the bottom (Fisher, 2006). These preferences were reported as reversed for women in the Baby Boomer generation.

Catalyst (2006) (http://www.catalystwomen.org/), a non-profit organization designated by The American Institute of Philanthropy as "the leading research and advisory organization working with businesses and the professions to build inclusive environments and expand opportunities for women at work," reported the results of ten years of research into the presence of women on the Boards of *Fortune 500* corporations from 1995-2005. During that period, the participation rate of women in these leadership roles rose from 9.6 to 14.7 percent. While acknowledging that some

progress had been made, Catalyst judged the progress as too slow, and noted that at this rate of change parity would not be reached for another 70 years.

The American Business Collaboration (ABC), a collaboration of seven leading U.S. companies (Abbott Laboratories, Deloitte & Touche, Exxon Mobil Corporation, IBM Corporation, Johnson & Johnson, PricewaterhouseCoopers, and Texas Instruments), looked at gender differences across generations in the workplace. A report funded by the ABC (Families and Work Institute, 2004) titled *Generation and Gender in the Workplace* concluded that survey data collected in 1977, 1992, 1997, and 2002 indicated that Gen X and Gen Y workers were less likely to be "work centric" than their Baby Boomer counterparts, and that these differences were especially pronounced among women. The study also concluded that "as women move through the life cycle their relative priorities on work and family change [toward being more family-centric], while this is not the case for men" (p. 8).

Interestingly, Zemke, Raines, and Filipczak (2000) concluded that, although the data is preliminary, the Net Generation (they call them "Nexters") may become known as the "gender-bending" generation in the sense that males will be more likely to play traditional female roles (e.g., parenting) and vice-versa. Mitchell (1995) reported that post-Boomer generation men are more likely to take on more household tasks such as cleaning and cooking while women of post-Boomer generations are more prone to take on traditional male roles such as home repair. Bittman, England, Sayer, Folbre, and Matheson (2003), found that as women's income approached that of their male spouses, there was more likely to be an equitable sharing of housework within families. They also found, however, that where traditional income relationships persisted (men making more money than women), women tended to do a larger share of the household jobs. Gerson (1993) interviewed 138 Gen X men and found them roughly split between those who expected to assume the traditional gender role as the primary breadwinner and those who were open to taking on more responsibility for child-rearing than previous generations. Loo and Thorpe (1998) also found that Gen Xers were much more liberal about gender roles than Baby Boomers.

In keeping with their generally conservative portrayal of the Millennial Generation (Net Generation or Gen Y), Howe and Strauss (2000) predict that Millennials will reverse the trend among Generation X workers toward later marriage and childbirth. Not only will Millennials marry and start families earlier according to Howe and Strauss (2000), but they predict that Millennial men and women will tend toward assuming more traditional career paths in the workplace in that "men will specialize more on construction and institution building" whereas "women (with their growing lead in arts and humanities degrees) [will focus] on values and culture" (p. 314).

By contrast, Twenge (2006) dismisses the conservative predictions made by Howe and Strauss primarily on an economic basis. She maintains that unless one spouse has a yearly income considerably over $100K, couples in the early 21st Century will not be able to have children, buy a decent home, and pay for healthcare, energy, and education. She points out that whereas Boomers only had to spend 25% of their income on housing when they were young couples, today's young married couples must spend more than 40% of a two earner income for housing.

Rosen (2001), a socio-psychologist at Cornell University, proposed a theory that highly educated "elite" Generation X workers are angry, especially at their Baby Boomer supervisors, but that they have suppressed their anger and adopted what he labeled a chameleon personality through which they try to adopt the traits they think others desire them to have. He found this "chameleonism"

phenomenon was more pronounced among Gen X men than among their female counterparts. Indeed, his analysis concluded that the anger of Gen X men was directed at women and foreigners as well as the Baby Boomers. According to Rosen, male Gen X knowledge workers perceive that women and immigrants are getting more opportunities in the workplace than they deserve.

Lyons, Duxbury and Higgins (2005) surveyed nearly 1,000 knowledge workers and found evidence that value differences are affected by both generational membership and gender. Orenstein (2000), based on interviews with nearly 250 women, found that most Baby Boomer women wanted to succeed in both career and family, whereas Gen X women were more comfortable with putting more emphasis on one or the other.

Zaslow (2006), writing in *The Wall Street Journal* about the Women Presidents' Organization conference held in Chicago in April 2006, reported that women presidents of companies stated that their younger female workers (primarily those in Generation Y) are reluctant to work as hard as their older female bosses. One of the speakers at the conference was Susan Shapiro Barash, author of a 2006 book titled *Tripping the Prom Queen: The Truth about Women and Rivalry*. Barash interviewed 500 women and found that rivalry among women was more prevalent among Generation X and Net Gen women than among members of earlier generations, but the pressure to hide rivalry from male workers was also increasing. Based upon surveys and interviews, Mooney (2005) concluded that although younger women in the contemporary workplace were more comfortable with their own ambition and that of their female peers than members of older generations, they often engaged in passive-aggressive behaviors to undermine other female workers.

Although some of the work published about gender differences in the workplace may be dismissed as "pop psychology," there is sufficient evidence that gender differences exist and that these differences also vary across the Baby Boomer, Gen X, and Net Gen generations. Both male and female members of Gen X and the Net Gen seem to be seeking more balance in their personal and work lives than their "workaholic" Baby Boomer parents, but this desire is more pronounced among women than men. Generation X and Y women appear to be much more prone to choose to emphasize either their work lives or their personal lives, whereas their older Baby Boomer counterparts have sought to "have it all."

Race, ethnicity, and culture are individual differences that most qualified researchers and self-professed authorities represented in the generational literature do not address. The major exception is Twenge (2006) who devotes considerable attention to race, although she largely ignores socioeconomic status in her analysis. With respect to race, her analysis of numerous studies conducted between the 1950s and today leads her to the conclusion that GenMe (roughly equivalent to the Millennials described by Howe and Strauss (2000)) "will continue the shift toward equality across races" [and] "that race will become less important as a defining characteristic" (p. 214).

Socioeconomic status (SES) is another variable that most generational scholars and pundits alike ignore. Most of the surveys, interviews, and other data collection approaches used in the research on generations have focused on participants that may be characterized as "elites" (college educated knowledge workers) rather than representatives from the blue-collar or service industry workforce. Thus, the results described above may not generalize to the wider population of people seeking employment in today's workplace. With respect to SES, more rigorous research is needed to examine whether the generational differences described by Howe and Strauss (2000), Lancaster and Stillman (2002), and others hold up when specifically looking at people living in the lower middle

and lower socioeconomic groups, especially with respect to the more than 35 million American living below the poverty line.

Race and SES are strongly related in the USA in that racial minorities are disproportionately represented in groups living below the poverty line. For example, higher proportions of racial minorities in the USA qualify for free lunch programs in schools and/or live in public housing. More and better research is needed to examine the complex interactions among race, SES, and generational differences. In addition, the types of survey methods used in the generational research reported to date do not reflect regional differences sufficiently because studies have more often been done with samples of convenience rather than more representative national samples. Another glaring weakness in the existing research literature is the lack of cross-cultural comparisons.

TECHNOLOGY SKILLS AND INFORMATION LITERACY

There is considerable debate about how widespread access to computers and Internet connectivity has affected members of the Net Generation who are the first people who have grown up in a world where these technologies are as commonplace as the telephone and the television were for earlier generations. Net Gen members have been described as the first "digital natives" of the Information Age (Prensky, 2001a).

It has become almost commonplace to assume that members of the so-called Net Generation (born between 1981 and 2000) have sophisticated technology skills simply because they are the first generation to grow up with computers and widespread, if not ubiquitous, Internet access. Although it is clear that middle and upper class Millennials are more likely to possess and use the latest high tech gear such as iPods, video phones, and game boxes, there is also evidence that their information literacy, especially with respect to judging the quality of information obtained on the Internet through search engines such as Google, is unacceptably weak (Oblinger & Oblinger, 2005).

The National Academies (http://www.nationalacademies.org/) has issued a new report titled *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future* that questions the presumed technological of today's younger generations (Committee on Science, Engineering, and Public Policy, 2006). The authors of this alarming report concluded that:

> It is easy to be complacent about America's competitiveness and preeminence in science and technology. We have led the world for decades, and we continue to do so in many research fields today. But the world is changing rapidly and our advantages are no longer unique. Without a renewed effort to bolster the foundations of our competitiveness, we can expect to lose our privileged position. For the first time in generations, the nation's children could face poorer prospects than their parents and grandparents did. (p. 8)

So what are the implications of the Information Age for how different generations learn and even more importantly how they transfer their learning to practice in the workplace? There is an on-going debate between those who believe that the NetGen is fundamentally different from previous generations in ways that require new approaches to teaching and learning and those who believe that how people learn is not fundamentally affected by generational membership. Prensky (2001a) defined one side of the debate by writing:

Our students have changed radically. Today's students are no longer the people our educational system was designed to teach. Today's students have not just changed incrementally from those of the past, nor simply changed their slang, clothes, body adornments, or styles, as has happened between generations previously. A really big discontinuity has taken place. One might even call it a 'singularity' - an event which changes things so fundamentally that there is absolutely no going back. This so-called 'singularity' is the arrival and rapid dissemination of digital technology in the last decades of the 20th century. (p. 1)

To support his contentions, Prensky (2001b) summarizes the findings of various basic research studies in neuroscience (often done with laboratory rats) from which he concludes that the digital natives of the Net Gen really do think differently from the digital immigrants of earlier generations:

Based on the latest research in neurobiology, there is no longer any question that stimulation of various kinds actually changes brain structures and affects the way people think, and that these transformations go on throughout life. The brain is, to an extent not at all understood or believed to be when Baby Boomers were growing up, massively plastic. It can be, and is, constantly reorganized. (Although the popular term rewired is somewhat misleading, the overall idea is right—the brain changes and organizes itself differently based on the inputs it receives.) The old idea that we have a fixed number of brain cells that die off one by one has been replaced by research showing that our supply of brain cells is replenished constantly. The brain constantly reorganizes itself all our child and adult lives, a phenomenon technically known as neuroplasticity. One of the earliest pioneers in this field of neurological research found that rats in "enriched" environments showed brain changes compared with those in "impoverished" environments after as little as two weeks. Sensory areas of their brains were thicker, other layers heavier. Changes showed consistent overall growth, leading to the conclusion that the brain maintains its plasticity for life. (p. 1)

Others take issue with Prensky's optimistic interpretations of the findings of contemporary brain science. For example, Martin Owen (2004), Director of Learning at FutureLab (http://www.futurelab.org.uk/) in the United Kingdom, argues that setting up dichotomies such as digital natives and digital immigrants may lead to poor decisions about the design of new teaching and learning environments. Owen cites an influential book by John Seely Brown and Paul Duguid (2000) titled *The Social Life of Information*:

Brown and Duguid's central theme is that access to information does not equate to knowledge. Brown and Duguid note, much of what we recognize as learning comes from informal social interactions between learners and mentors. These social interactions are difficult to achieve in mediated instruction. They recognize that technology can enhance instruction in remarkable ways; however, it cannot replace the insights that students receive by struggling to make sense of information with both peers and mentors. They contend that the gung-ho tunnel vision of commentators like Prensky - seeing only one way ahead (if all you have is a hammer, everything looks like a nail!), has led to erroneously simplified and unrealistic expectations of what our future in the information age will be like.

Even Prensky (2001b) tempers his enthusiasm when it comes to considering the learning results that teachers are reporting concerning their digital native Millennial students:

Still, we often hear from teachers about increasing problems their students have with reading and thinking. What about this? Has anything been lost in the Digital Natives' "reprogramming" process? One key area that appears to have been affected is reflection. Reflection is what enables us, according to many theorists, to generalize, as we create "mental models" from our experience. It is, in many ways, the process of "learning from experience." In our twitch-speed world, there is less and less time and opportunity for reflection, and this development concerns many people. One of the most interesting challenges and opportunities in teaching Digital Natives is to figure out and invent ways to include reflection and critical thinking in the learning (either built into the instruction or through a process of instructor-led debriefing) but still do it in the Digital Native language. We can and must do more in this area. (p. 5)

Developmental psychologist, Jane Healy, argued, in her 1998 book *Failure to Connect: How Computers Affect Our Children's Minds – For Better or Worse,* that the development of abstract reasoning ability requires the physical experience of action, the kind of experience that is decreased when children are placed in passive modes for many hours by television. She also expressed concerns about the lack of language stimulation and the accompanying decline in linguistic capabilities that stem from over-exposure to video games. Whereas Prensky (2006) argued that video games stimulate children's creativity, Healey (1998) worried that today's interactive media actually stifles their intellectual curiosity.

Will members of the Net Generation arrive in the workplace with advanced technology skills and strong information literacy as some have predicted? Or are their technology skills shallow and superficial? Is their information literacy limited in fundamental ways that actually limits their powers to reflect, reasons, and make decisions? The research literature in this area provides no clear answers, and so the debate continues. On the one hand, some researchers and pundits suggest that the information literacy of the Net Generation (digital natives) far exceeds that of earlier generations (digital immigrants), and that this has profound implications for how the Net Generation should be educated and trained. On the other hand, some argue that the media-saturated environment in which today's youth have grown up has actually stifled some of the fundamental thinking and social interaction skills that derive from human-to-human interaction, including a decline in the capacity to reason, engage in critical reflection, and exhibit intellectual curiosity.

There is, of course, a middle ground that suggests that how people learn, reason, reflect, and create are robust human capacities that are not unduly influenced by the Information Age, for better or for worse. Neil Postman (2003), the late Columbia University professor and author of several books about the Information Age and the impact of technology on culture such as *Technopoly* (1993) and *The End of Education* (1995), wrote:

> To my knowledge, there does not exist any compelling evidence that PCs or any other manifestation of computer technology can do for children what good, well-paid, unburdened teachers can do. Nor is there any evidence whatsoever that children in wired classrooms do any better than children who aren't. (p. 193)

Without better research, the debate will continue about the impact of the Information Age on the learning needs, preferences, and potentialities of the Net Generation. In my judgment, it is especially difficult to leap from research with rats, as Prensky (2001b) does, that indicates that rodents in enriched environments develop positive brain changes in as little as two weeks over their kin in impoverished environments to the conclusion that because the Net Generation has grown up as digital natives their brains are somehow wired differently than their Gen X parents and Baby Boomer grandparents. This is a popular notion, but one with no solid scientific support.

TRAINING PREFERENCES ACROSS THE GENERATIONS

Some have tried to make the case that Generation X and even more so the Net Generation, have been positively affected by the sophisticated interactive games and simulations they have spent so much of their youth playing. For example, Beck and Wade (2004), authors of a book called *Got Game: How the Gamer Generation is Reshaping Business Forever*, wrote:

How hard this new cohort works, how they try to compete, how they fit into teams. How they take risks – all are different in statistically verifiable ways. And those differences are driven by one central factor: growing up with video games. p. 2

Whether playing interactive video games has bad or good effects is the subject of much speculation, but relatively little robust research. And even when research has been done, there is substantial debate about its quality and interpretation. For example, several prominent psychologists (e.g., Anderson & Bushman, 2001; Bensley & Eenwyk, 2001; Gentile & Anderson, 2003) have presented research that indicates that some popular video games such as *Doom*, *Grand Theft Auto* and *Tomb Raider* encourage antisocial and even violent behavior, but other researchers have called such research into question (Cassell & Jenkins, 1998; Greenfield & Cocking, 1996; Griffiths, Davies, & Chappell, 2003; Sherry, 2001; Squire & Jenkins, 2003; Wolf & Perron, 2003). Whereas most serious researchers, whether they see video games as harmful or not, issue tentative and cautious conclusions, others, including politicians, have used some of the research cited above as the basis for sounding alarms that video games are corrupting the minds of our youth (e.g., Grossman & DeGaetano, 1999).

Meanwhile, a few gaming scholars have concluded that video games may actually be having positive effects on the young people who play them. A highly respected literacy and applied linguistics professor from the University of Wisconsin, James Paul Gee (2003), has concluded that playing contemporary video games has positive outcomes with respect to many cognitive skills. In his book, *What Video Games Have to Teach Us About Learning and Literacy*, Gee (2003) identifies 36 important learning principles that are inherent in good video games. These include enhancing the ability to detect patterns in seemingly chaotic events and learning to think like a scientist.

The notion that video games may do more good than harm, seemingly a completely implausible idea just a few years ago, is beginning to enter the public's consciousness as evidenced by recent books such as *Playing the Future: What We Can Learn from Digital Kids* (Rushkoff, 1999), *Everything Bad Is Good For You* (Johnson, 2005), *Why Video Games Are Good For Your Soul* (Gee, 2005), and *Don't Bother Me Mom – I'm Learning* (Prensky, 2006). For example, Johnson (2005) states that playing interactive games yields "collateral learning" related to decision-making:

Start with the basics: far more than books or movies or music, games force you to make decisions. Novels may activate our imagination, and music may conjure up powerful emotions, but games force you to decide, to choose, to prioritize. All of the intellectual benefits of gaming derive from this fundamental virtue, because learning how to think is ultimately about learning how to make the right decision: weighing evidence, analyzing situations, consulting your long-terms goals, and then deciding. (p. 41)

Holland, Jenkins, and Squire (2003) go so far as to suggest that interactive video games can be used to accommodate learners with different learning styles:

…for example, art students might better grasp basic physics and engineering principles in the context of an architectural design program. Many of us whose eyes glaze over when confronted with equations on a blackboard find we can learn science more thoroughly when it builds upon our intuitive understandings and direct observations, yet many important aspects of the physical world cannot be directly experienced in the classroom. Students often complain that they see few real-world applications for what they learn in advanced math and science classes, yet they might draw more fully on such knowledge if it was the key to solving puzzles or overcoming obstacles in a game environment – if the knowledge were a tool rather than an end. It is both a motivational distinction and a matter of mindset (and what is the object of teaching if not literally to change one's mind?). p. 28

In addition to the research indicating that playing video games may have a positive impact on cognitive development (Gee, 2003; Squire & Jenkins, 2003), Beck and Wade (2004) and others have studied the attitudes and performance of so called "gamers" in the workplace and recommend that older generations have much to learn from them. Many gamers (a popular name for people who play interactive games regularly) actually believe that they are learning important things through their interactive play, and not just wasting their time. For example, Beedle (2004) surveyed players of the popular online game, *Everquest*, and found that the majority of the players believe that playing this game increases their creativity and problem-solving abilities. Of course, there is a great leap from someone believing that playing a game increases creativity to providing demonstrative evidence that playing a game increases creativity. The latter, more desirable, research evidence does not yet exist. Other studies have detected adult-like expert behaviors among children who frequently play video games. For example, Vandenventer and White (2002) reported that observations of children teaching adults how to play video games exhibited expert behaviors such as:

> …actively seeks new information; incorporates new information; assesses situations using multiple pieces of data; organizes, classifies, and categorizes information; consistently applies successful behaviors; is confident about one's own knowledge; is willing to take risks; employs corrective action when needed; can consider input from multiple sources; recognizes patterns; uses holistic thinking; is able to integrate information with behaviors; uses inductive thinking; strategizes; thinks critically; and recognizes constraints and misinformation. (p. 46)

Steinkuehler (in press) investigated the cognitive effects of playing massively multiplayer online games and found that players exhibit many skills that most employers would want their employees to exhibit in the 21st Century:

> [Massively multiplayer gaming] communities instantiate their collective intelligence (Levy, 1999) in the form of unofficial user manuals that are far more accurate than official ones, authoring and maintaining database-backed websites that function as "how to" manuals for the game (Squire & Steinkuehler, 2005; Steinkuehler, 2005e), and they create in-game apprenticeship systems (Galarneau, 2005) that enculturate newcomers into valued cultural practices: Gamers who have already mastered the social and material practices requisite to gameplay apprentice, through scaffolded and supported interactions, newer gamers who lack such knowledge and skill.

Slator and Associates (2006) provide evidence of the effectiveness of multi-user role playing games in subjects as diverse as geology and microeconomics. Mitchell and Savill-Smith (2004) reviewed the literature on gaming in education and concluded that well-designed interactive games have the potential to:

- engage unmotivated learners
- engage learners who lack confidence in ability to learn
- develop skills in literacy
- develop mathematical skills
- develop skills in visualization
- develop capacity for strategic and tactical decision making
- develop critical thinking and problem solving skills

Beck and Wade (2004) maintain that gamers prefer to learn through trial and error and like to play to win. Using the results of a survey of 2,500 people in the USA, Beck and Wade argue that

gamers possess the types of 21st century skills that business demands today, such as the capacity to multitask, take risks, and exhibit leadership. To take advantage of these skills, Beck and Wade recommend that businesses present their workers with challenges and acknowledge success or failure in meeting the challenges in public ways.

Kapp (2006), in a presentation to the Lockheed Martin Corporation titled "Bridging the Boomer/Gamer Knowledge Gap," concludes that Boomer knowledge is formal, structured, hierarchical, and based on a distinction between the interface and information whereas gamer (Net Generation) knowledge is informal, unstructured, non-hierarchical, and based on the assumption that the information is the interface. With respect to the knowledge transfer that must occur as the Baby Boomers retire and the Gamers enter the workforce, Kapp recommends that organizations break out of the "class mentality" think in terms of learning events. He quotes John Cone, former head of Dell Learning, as saying:

> The ideal 'learning event' at Dell has a class size of one, lasts 5 to 10 minutes, and takes place within 10 minutes of when someone recognizes that he or she needs to know something. Our challenge is to reduce learning to its smallest, most-useful increments and to put the learner in charge of the entire process.

Kapp concluded by recommending the development of "virtual apprenticeships" that would approximate the realism and engagement levels of today's best interactive video games. Quinn (2005) in his book titled *Engaging Learning: Designing e-Learning Simulation Games,* describes the process of producing such engaging virtual learning environments. Interestingly, Quinn reports that:

> …the Masie Center found that 70 percent of survey respondents would be very interested in a learning process that has computer games. I'll bet most folks developing learning would be thrilled to have 70 percent of their audience heading into the learning experience very interested.

It is important to keep in mind that research focused on the impact of video games on the thinking and learning skills of those who play them is subject to the same problems that undermine confidence in all forms of educational research (Eisenberg, 1995). Generally, the measures used to assess aptitude, attitudes, outcomes, and other variables are much less reliable and valid than those employed in the "harder sciences." Despite the weaknesses of the research, there is a growing consensus among educational and psychological researchers that the positive effects of playing video games may outweigh the negative, and even more importantly, that those who play video games may be developing skills and expectations that can be leveraged to their advantage in some learning situations and environments.

It is also clear that members of the Net Gen spend more time playing games than Gen Xers and that Gen Xers in turn play more than Baby Boomers (Rideout, Roberts & Foehr, 2005). Another trend is obvious: the interactive games that each successive generation has played have become increasingly sophisticated. Today, members of the Net Gen seem especially susceptible to becoming "addicted" to massive multiplayer online games such as *EverQuest* and *Final Fantasy*. Some argue that the increased fidelity of contemporary video games decreases the likelihood that members of the Net Gen will be satisfied with the relatively dull screen layout and limited interactions of most training games and simulations (Aldridge, 2005, 2006; Rosenberg, 2006). In any case, with new evidence suggesting that playing video games does more good than bad and with the workforce increasingly made up of workers who have spent large amounts of their free time playing these games, instructional designers and educational researchers are advised to continue to explore the real and potential effectiveness of training games and simulations in the workplace.

For decades, there has been a debate among educational researchers and learning theorists about the effectiveness of various pedagogical approaches (Jonassen, 1991; Vrasidas, 2000). The scholarly debate among educational researchers and learning theorists about the relative merit of behaviorism, cognitivism, constructivism, and social constructivism continues. Indeed, some argue that this debate is devolving into ideological stances rather than carefully examined theoretical models (Kirschner, Sweller, & Clark, 2006). In any case, this debate largely takes place in scholarly journals that few people read or at research conferences attended only by researchers, and thus most practitioners are unaware of it.

Meanwhile, in the real world of business and industrial training, practitioners are likely to change their instructional approaches based primarily on the promotion of the latest and greatest training technologies touted to "revolutionize" training rather than on the basis of dubious learning theory or weak research findings. At the same time, Generation "experts" are making big bucks as consultants who issue recommendations that are also uninformed by strong theory or the findings of sound research. For example, Chester (2002) offers the following five basic principles for training the Net Generation without any reference to principles of learning theory or findings from educational research studies:

- Make it fun
- Engage them
- Make it fresh
- Keep up the pace
- Reward skill development

In another book titled *Getting Them To Give A Damn,* Chester (2005) offers six slightly more specific guidelines for training, although again unsupported by theory or research:

- Begin with an orientation, not skills training
- Assess what they know
- Continually reinvent your training
- Communicate where to turn for answers
- Don't just train the what, train the why
- Keep training fun, interactive, and engaging

Lancaster and Stillman (2002) also fail to reference learning theories or the results of educational research in their "Training the Generations" chapter. They do include a few "buzzwords" from corporate training literature, such as "learning organization" and "lifelong learning," but do not list sources for these ideas. Their training advice is boiled down what they call "the three Ss": setting, style, and substance (p. 282). These are elaborated as the following principles:

- Make sure the setting for training is comfortable.
- Pay attention to the learning styles of the different generations represented.
- Be sure the training has real substance.

In her book titled *Connecting Generations: The Sourcebook for a New Workplace*, Raines (2003) provides five tips for training the Mature Generation, four tips for the Baby Boomers, seven for Generation X trainees, and three for the Net Generation. All of these tips lack any references to learning theory or educational research.

Zemke, Raines, and Filipczak (2000) provide advice for training "Veterans, Boomers, Xers, and Nexters" throughout their book without mention of learning theory or research findings. For example, without providing any clear references, they offer the following "points to keep in mind" when training the Net Generation, (p. 244):

- They read more than any generation ahead of them.
- They are used to learning in a highly interactive way.
- The popularity and productivity of role-playing and other interactive activities work in inverse proportion to their age.
- The experts say that the Millennial Generation will make the Xers look like technological dinosaurs.

In contrast to the dubious bromides provided by the "experts" quoted above, a review of educational research reveals that there are virtually no research-based findings or evidence drawn from robust learning theory that supports the differential effectiveness of different instructional designs or strategies across the generations. Nor is there a compelling case for the development of a new instructional design model to accommodate generational differences.

DIFFERENTIAL EFFICACY OF EDUCATIONAL TECHNOLOGIES

By far the most common approach to conducting research to determine the effectiveness of various educational technologies has been to compare technological approaches with traditional classroom delivery approaches (Cuban, 1986; Saettler, 1990). The prevalence of these media comparison studies stems from the fact that the experimental comparative method remains the research strategy most frequently recommended in the professional research design literature. Experimental (or more realistically, quasi-experimental) methods are designated in most educational and psychological research textbooks as the "gold standard" of educational research methods. Suchman (1967) praised experimental comparisons thusly: "the logic of this design is foolproof. Ideally, there is no element of fallibility. Whatever differences are observed between the experimental and control groups, once the above conditions are satisfied, must be attributed to the program being evaluated" (pp. 95-96).

Educational researchers have conducted media comparison studies from the earliest days of the introduction of technology into education and training. Saettler (1990) reports that comparisons of educational films with classroom instruction were conducted as early as the 1920s. Comparative research designs have been applied to every new educational technology that has come along, including programmed instruction, instructional television, computer-based instruction, and more recently, various forms of Web-based e-learning. The results of such media comparison research studies have usually been "no significant differences" (Clark, 1983; Lumsdaine, 1963; Mielke, 1968; Schramm, 1977). That is, the vast majority of the media comparison studies have failed to find evidence for the differential effectiveness for one educational technology over another, or for any educational technology over traditional leader-led classroom instruction. Various large-scale reviews

of the educational technology research literature have confirmed the "no-significant differences" phenomenon again and again (Dillon & Gabbard, 1998; Fabos & Young, 1999).

Two large-scale research literature reviews (Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Wallet, Fiset, & Huang, 2004; Tallent-Runnels, Thomas, Lan, Cooper, Ahern, Shaw, & Xiaoming, 2006) that examined the comparative effectiveness of distance/online instruction and classroom instruction exemplify this trend. Both of these studies were published in the *Review of Educational Research*, published by the American Educational Research Association. These reviews are important because interactive online learning, either by itself or integrated with more traditional training methods into some form of "blended learning" will undoubtedly be widely used in initiatives to provide Gen X and Net Gen workers with education, training, and continuing professional development opportunities (Bonk & Graham, 2006; Rosenberg, 2001). Relatively little is known about how Gen X and Net Gen learners learn online, and what little is known is sometimes puzzling in light of the supposed affinity for technology that Gen Xers and especially the Net Gen purportedly exhibit. For example, Dziuban, Hartman, Juge, Moskal, and Sorg (2006) wrote:

> Blended teaching and learning responds to what Oblinger (2003) and Wendover (2002) define as the new-generation learners (millennials). These students, born after 1980, have grown up with what other generations view as new technologies. They are connected (mostly to each other) and proficient in the use of communicative technology, often viewing what transpires in college classrooms as slow-moving and uninteresting. Wendover (2002) describes a classroom scenario where four generations are present (matures, baby boomers, generation Xers, and millennials). He suggests that matures' and boomers' preferred mode of communication is prolonged discussion. The generation-X students simply want to move on with it, while the millennials are quite content to sit and watch the goings on. Our experience at UCF [University of Central Florida] shows that younger students are less satisfied with their online experience.

Bernard et al. (2004) carried out a meta-analysis of 232 quasi-experimental comparisons of distance education courses with face-to-face instruction courses. The studies used in this meta-analysis were published between 1985 and 2002. Although the researchers found over 1,000 such comparisons in the refereed research literature during that period, the majority of the studies did not meet the criteria for inclusion in the meta-analysis. Dillon and Gabbard (1998) and Fabos and Young (1999) reported similar rejection rates. Media comparison studies are often flawed by problems such as specification error, lack of linkage to theoretical foundations, inadequate literature reviews, poor treatment implementation, major measurement flaws, measurement of learning outcomes that are inconsequential for research participants, inadequate sample sizes, inaccurate statistical analyses, and meaningless discussions of results (Reeves, 1993). Bernard et al.'s (2004) meta-analysis yielded very small, but statistically significant, mean effect sizes for interactive distance education over traditional classroom instruction on student achievement and a slightly larger effect size for retention. The findings can be boiled down to two overall conclusions: 1) distance education and classroom instruction are equally effective as instructional delivery systems, and 2) learners tend to drop out of online courses at slightly higher rates than they do in classroom-based courses. Obviously, such findings, in keeping with thousands of media comparison studies that came before, provide practitioners with inadequate guidance regarding the design features needed for effective teaching and learning with technology.

Tallent-Runnels et al. (2006) conducted a literature review of 76 published research studies that investigated the effectiveness of online courses using a variety of quantitative, qualitative, and mixed-

methods designs. Only a small subset of the 76 studies involved comparisons between online and face-to-face courses. The overall findings of their review were summarized as follows:

> Many researchers have attempted to investigate the cognitive aspects of online learning. Two major findings can be summarized from the research. First, many studies focused on comparing students' learning in online and traditional environments. Learning was operationally defined in various ways, including by test scores, course grades, cumulative GPA's, and authentic performance of learned content. Although some researchers raised concerns about the validity of the findings because of inadequacies in research design, measurement, and analysis, overwhelming evidence has shown that learning in an online environment can be as effective as that in traditional classrooms. Second, students' learning in the online environment is affected by the quality of online instruction. Not surprisingly, students in well-designed and well-implemented online courses learned significantly more, and more effectively, than those in online courses where teaching and learning activities were not carefully planned and where the delivery and accessibility were impeded by technology problems. This finding challenges online instructors to design their courses in accordance with sound educational theories. An even bigger challenge to education researchers is to further investigate the features of online teaching that will most benefit students.

No strong conclusions can be drawn about the effectiveness of educational technologies based on the literature reviews conducted by Bernard et al. (2004) and Tallent-Runnels et al. (2006) or any of the long history of media comparison studies in the field of educational technology outlined above. Technologies are being used to support training and the performance of workers belonging to Generation X and the Net Generation. However, the bulk of published research indicates that training delivery modalities such as online learning versus classroom instruction yield similar results. What should make a difference is the instructional design (pedagogical methods) of a learning environment. As argued by Clark (1983), if the same instructional design is delivered via two different modalities, it makes no sense to expect different outcomes. However, one modality may be preferred over another for other reasons such as differences in cost, accessibility, and efficiency.

CONCLUSIONS

Although there are certainly many doubters, the consensus of scholarship and opinion is that there are generalizable generational differences that are worth taking into consideration in the "knowledge worker" or professional workplace and other contexts such as higher education. For example, there are differences with respect to attitudes, work habits, and motivators that anyone managing cross-generational teams should understand. Managers and workers should also be aware that generational differences in attitudes toward the balance between work and other parts of life such as family may vary to some degree by gender. However, it is definitely not recommended to make assumptions about any one individual, regardless of gender or other factors, based upon his/her membership in a chronological generational cohort.

It is also important to note that there are glaring weaknesses in the generational research, especially with respect to the understanding of generational differences among people in the blue collar and service industry workforces, and with regard to people of lower socioeconomic status. In the USA, the 2008 presidential election season is upon us, and some candidates speak of there now being two Americas, one wealthy and getting richer, and the other struggling to keep up from paycheck to paycheck or hopelessly stuck below the poverty line. Setting the validity of such a dichotomous characterization aside, it is obvious that most of the existing generational research does not address socioeconomic status adequately. As a result, the generalizations derived from the extant

generational research are probably not as applicable in workplaces that hire people who are not members of the "elites" who have participated in most generational survey studies.

The major question addressed in this review is whether generational difference is a variable important enough to be considered during the design of instruction or the use of different educational technologies. At this time, the weight of the evidence is negative. Generational differences are evident in the workplace, but they are not salient enough to warrant the specification of different instructional designs or the use of different learning technologies. That said, there are some intriguing areas for further research, especially with respect to the design and use of interactive games and simulations.

Generational differences research suffers from many of the same weaknesses found in learning styles research. An extensive review of the learning styles literature (Coffield, Moseley, Hall, & Ecclestone, 2004) throws grave doubt on the validity and utility of employing learning styles as a basis for accommodating students of any generation. The reviewers found little rigorous scientific support for the very existence of the more than 70 learning styles models reported in hundreds of published studies from the educational and psychological research literature. According to Coffield et al. (2004), even the most widely studied models have not held up to scrutiny. The same can be said of the extant scholarship focused on generational differences.

In light of the weak nature of generational differences as a measurable construct, we certainly do not need any quasi-experimental studies aimed at determining the effectiveness of different instructional designs or educational technologies across generations. On the other hand, both feasible solutions and reusable design principles are sorely needed with respect to the intersection of generational differences and instructional design. Instead of worrying about whether Boomers, GenXers or Millennials will learn more from direct instruction or virtual reality games, instructional designers and educational technology researchers working closely with practitioners and subject matter experts should begin by identifying the needs of any given set of learners, design the best possible prototype learning environments *in situ*, and then conduct iterative cycles of formative evaluation and refinement to optimize the solution and reveal robust design principles. These are the features of "design research," an approach which I and others endorse (Reeves, 2006). Anyone seeking more information about design research is directed to a web-resource created by Ph.D. students here at The University of Georgia at: http://projects.coe.uga.edu/dbr/index.htm

REFERENCES

Aldridge, C. (2006). *Simulations and the future of learning: An innovative (and perhaps) revolutionary approach to e-learning.* San Francisco: Pfeiffer.

Aldridge, C. (2005). *Learning by doing: A comprehensive guide to simulation, computer games, and pedagogy in e-learning and other educational experiences.* San Francisco: Pfeiffer.

Anderson, C. A. , & Bushman, B.J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science, 12,* 353-359.

Barash, S. S. (2006). *Tripping the prom queen: The truth about women and rivalry.* New York: St. Martin's Press.

Beck, J. C., & Wade, M. (2004). *Got game: How the gamer generation is reshaping business forever.* Boston, MA: Harvard Business School Press.

Beedle, J. B. (2004). What educators can learn from multiplayer computer gaming: A study of who is playing and their perceptions of learning. *Dissertations Abstracts International*, AAT 3155858.

Bensley, L., & Eenwyk, J. (2001). Video games and real-life aggression: Review of the literature. *Journal of Adolescent Health, 29*, 244-257.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., Wallet, P. A., Fiset, M., & Huang, B. (2004). How does distance education compare to classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research*, *74*(3), 379-439.

Bittman, M., England, P., Sayer, L., Folbre, N., & Matheson, G. (2003). When does gender trump money? Bargaining and time in household work. *American Journal of Sociology*, *109*(1), 186–214.

Blohowiak, D. (2002) Book review: *When Generations Collide* by Lancaster & Stillman. Retrieved March 4, 2006, from http://www.leadwell.com/db/1/4/81/

Bonk, C. J., & Graham, C. R. (Eds.). (2006). *The handbook of blended learning: Global perspectives, local designs*. San Francisco: Pfeiffer.

Brooks, D. (2000, November 5). What's the matter with kids today? Not a thing. *New York Times*.   Retrieved January 7, 2006, from http://query.nytimes.com/gst/fullpage.html?res= 9B06E1D91E31F936A35752C1A9669C8B63 &pagewanted=2

Brown, J. S., & Duguid, P. (2000). *The social life of information*. Cambridge, MA: Harvard Business School Press.

Cassell, J., & Jenkins, H. (1998). *From Barbie to Mortal Kombat: Gender and computer games*. Cambridge, MA: MIT Press.

Catalyst. (2006). *2005 Catalyst census of women board directors of the Fortune 500 – Ten years later: Limited progress, challenges persist*. New York: Catalyst. Retrieved April 20, 2006, from: http://www.catalystwomen.org/files/full/2005%20WBD.pdf

Chester, E. (2005). *Getting them to give a damn: How to get your front line to care about your bottom line*. Chicago: Dearborn Trade Publishing.

Chester, E. (2002). *Employing generation why?: Understanding, managing, and motivating your new workforce*. Lakewood, CO: Tucker House Books.

Clark, R. E. (1983). Reconsidering research on learning with media. *Review of Educational Research*, *53*(4), pp. 445-459.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004) *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. London: Learning and Skills Research Centre. Retrieved February 2, 2006, from http://www.lsda.org.uk/files/pdf/1543.pdf

Committee on Science, Engineering, and Public Policy. (2006). *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, DC: National Academies Press. Retrieved June 8, 2006, from http://www.nap.edu/books/0309100399/html

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York: Teachers College Press.

Debard, R. D. (2004). Millennials coming to college. In R. D. Debard & M. D. Coomes (Eds.). *Serving the millennial generation: New directions for student services* (pp. 33-45). San Francisco: Jossey-Bass.

Dillon, A. & Gabbard, R. (1998) Hypermedia as an educational technology: A review of the quantitative research literature on learner comprehension, control and style. *Review of Educational Research*, *68*(3), 322-349.

Dziuban, C., Hartman, J., Juge, F., Moskal, P., & Sorg, S. (2006). Blended learning enters the mainstream. In C. J. Bonk & C. R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 195-206). San Francisco: Pfeiffer.

Eisenberg, J. (1995) The limits of educational research: Why all research and grand plans in education are futile and wasteful. *Curriculum Inquiry, 25*, 367–80.

Fabos, B., & Young, M. D. (1999). Telecommunications in the classroom: Rhetoric versus reality. *Review of Educational Research*, *69*(3), 217-259.

Families and Work Institute. (2004). *Generation and gender in the workplace*. New York: American Business Collaboration.

Fisher, A. (2006). *What do gen Xers want? Here's how some of Fortune's 100 Best Companies to Work For keep young up-and-comers happy*. Retrieved May 4, 2006, from http://money.cnn.com/2006/01/17/news/companies/bestcos_genx/index.htm

Gee, J. P. (2005). *Why video games are good for your soul: Pleasure and learning*. Melbourne, Australia: The Learner Press.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gentile, D. A. & Anderson, C. A. (2003). Violent video games: The newest media violence hazard. In D. A. Gentile (Ed.), *Media violence and children* (pp. 131-152). Westport, CT: Praeger Publishing.

Gerson, K. (1993). *No man's land: Men's changing commitment to family and work*. New York: Basic Books.

Gillon, S. M. (2004). *Boomer nation: The largest and richest generation ever, and how it changed America*. New York: Free Press.

Gravett, L. & Throckmorton, R. (2007). *Bridging the generation gap: How to get radio babies, boomers, Gen Xers, and Gen Yers to work together and achieve more*. Franklin Lakes, NJ: The Career Press.

Greenfield, P. M., & Cocking, R. R. (1996). *Interacting with video*. Norwood, NJ: Ablex.

Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2003). Breaking the stereotype: The case of online gaming. *CyberPsychology and Behavior*, 6, 81–91.

Grossman, D., & DeGaetano, G. (1999). Stop teaching our kids to kill: A call to action against TV, movie and video game violence. New York: Crown Publishers.

Healy, J. (1998). *Failure to connect: How computers affect our children's minds - for better and worse*. New York: Simon & Schuster.

Holland, W., Jenkins, H., & Squire, K.. (2003). Theory by design. In M. J. P. Wolf & B. Perron (Eds.). *The video game theory reader* (pp. 25-46). New York: Routledge.

Howe, N., & Strauss, W. (2000). *Millennials rising: The next great generation*. New York: Vintage Books.

Howe, N., & Strauss, W. (1993). *13th gen: Abort, retry, ignore, fail?* New York: Vintage Books.

Johnson, S. (2005). *Everything bad is good for you: How today's popular culture is actually making use smarter*. New York: Riverhead Books.

Jonassen, D. H. (1991). Objectivism vs. constructivism. *Educational Technology Research and Development*, *39*(3), 5-14.

Kapp, K. M. (2006). Bridging the boomer/gamer knowledge gap. Retrieved May 18, 2006, from http://www.karlkapp.com/materials/Lockheed_web.pdf

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, *41*(2), 75-86.

Lancaster, L. C., & Stillman, D. (2002). *When generations collide. Who they are. Why they clash. How to solve the generational puzzle at work*. New York: Collins Business.

Loo, R., & Thorpe, K. (1998). Attitudes toward women's roles in society: A replication after 20 years. *Sex Roles*, *39*(11/12), 903–912.

Lumsdaine, A. A. (1963). Instruments and media of instruction. In N. Gage (Ed.), *Handbook of research on teaching*. Chicago: Rand McNally.

Lyons, S., Duxbury, L, & Higgins, C. (2005). Are gender differences in basic human values a generational phenomenon? *Sex Roles, 53*(9/10), 763-778.

Manchester, W. (1974). *The glory and the dream: A narrative history of America: 1932-1972*. Boston: Little, Brown, and Company.

Marston, C. (2007). *Motivating the "what's in it for me" workforce: Manage across the generational divide and increase profits*. Hoboken, NJ: John Wiley & Sons.

Martin, C. A., & Tulgan, B.. (2002). *Managing the generational mix*. Amherst, MA: HRD Press.

Martin, C. A., & Tulgan, B. (2001). *Managing generation Y*. Amherst, MA: HRD Press.

Mielke, K. W. (1968). Questioning the questions of ETV research. *Educational Broadcasting*, *2*, pp. 6-15.

Mitchell, S. (1995). *The official guide to the generations: Who they are, how they live, what they think*. Ithaca, NY: New Strategist Publications.

Mitchell, A. & Savill-Smith, C. (2004). *The use of computer and video games for learning: A review of the literature.* London: Learning and Skills Development Agency.

Mooney, N. (2005). *I can't believe she did that!: Why women betray other women at work.* New York: St. Martin's Press.

Oblinger, D. G. (2003). Boomers, gen-xers, and millennials: Understanding the "new students." *EDUCAUSE Review, 38*(4), 36-45.

Oblinger, D., & Oblinger, J. (Eds.). (2005). *Educating the Net Gen.* Washington, DC: EDUCAUSE.

O'Neill, S. (2000) Millennials Rising by Neil Howe and William Strauss. *Flak.* Retrieved February 3, 2006, from http://flakmag.com/books/mill.html

Orenstein, P. (2000). *Flux: Women on sex, work, love, kids, and life in a half-changed world.* New York: Doubleday.

Owen, M. (2004). *The myth of the digital native.* Retrieved February 7, 2006, from http://www.futurelab.org.uk/viewpoint/art26.htm

Postman, N. (2003). Questioning media. In M. S. Pittinsky, M. S. (Ed.). *The wired tower: Perspectives on the impact of the internet on higher education* (pp.181-200). Upper Saddle River, NJ: Prentice Hall.

Postman, N. (1995). *The end of education: Redefining the value of school.* New York: Knopf.

Postman, N. (1993). *Technopoly: The surrender of culture to technology.* New York: Vintage Books.

Prensky, M. (2006). *Don't bother me, mom – I'm learning: How computer and video games are preparing your kids for twenty-first century success.* St. Paul, MN: Paragon House.

Prensky, M. (2004). *Digital game-based learning.* New York: McGraw-Hill.

Prensky, M. (2001a). Digital natives, digital immigrants. *On the Horizon.* NCB University Press, *9*(5). Retrieved January 11, 2006, from http://www.marcprensky.com/writing/

Prensky, M. (2001b). Digital natives, digital immigrants, part II: Do they really think differently. *On the Horizon.* NCB University Press, *9*(6). Retrieved January 11, 2006, from http://www.marcprensky.com/writing/

Quinn, C. (2005). *Engaging learning: Designing e-learning simulation games.* San Francisco: Pfeiffer.

Raines, C. (2003). *Connecting generations: The sourcebook for a new workplace.* Menlo Park, CA: Crisp Publications.

Reeves, T. C. (2006). Design research from the technology perspective. In J. V. Akker, K. Gravemeijer, S. McKenney, & N. Nieveen (Eds.), *Educational design research* (pp. 86-109). London: Routledge.

Reeves, T. C. (1993). Pseudoscience in computer-based instruction: The case of learner control research. *Journal of Computer-Based Instruction, 20*(2), 39-46.

Reeves, T. C., & Oh, E. J. (2007). Generation differences and educational technology research. In J. M. Spector, M. D. Merrill, J. J. G. van Merriënboer, & M. Driscoll. (Eds.) *Handbook of research on educational communications and technology* (pp. 295-303). Mahwah, NJ: Lawrence Erlbaum Associates.

Rideout, V., Roberts, D. F., & Foehr, U. G. (2005). *Generation M: Media in the lives of 8-18 year-olds.* Kaiser Family Foundation. Retrieved February 9, 2006, from http://www.kff.org/entmedia/upload/ Generation-M-Media-in-the-Lives-of-8-18-Year-olds-Report.pdf

Rosen, B. C. (2001). *Masks and mirrors: Generation X and the chameleon personality.* Westport, CT: Praeger.

Rosenberg, M. J. (2006). *Beyond e-learning.* San Francisco: Pfeiffer.

Rosenberg, M. J. (2001). *E-learning: Strategies for delivering knowledge in the digital age.* New York: McGraw-Hill.

Rushkoff, D. (1999). *Playing the future: What we can learn from digital kids.* New York: Riverhead Books.

Saettler, P. (1990). *The evolution of American educational technology.* Englewood, CO: Libraries Unlimited

Schooley, C. (2005). *Get ready: The millennials are coming! Changing workforce.* Cambridge, MA: Forrester Research.

Schramm, W. (1977). *Big media, little media.* Beverly Hills, CA: Sage Publications.

Shelton, C., & Shelton, L. (2005). *The next revolution: What gen x women want at work and how their boomer bosses can help them to get it.* Mountain View, CA: Davies-Black Publishing.

Sherry, J. L. (2001). The effects of violent video games on aggression: A meta-analysis. *Human Communication Research, 27*, 409-431.

Slator, B. M. and Associates. (2006). *Electric worlds in the classroom: Teaching and learning with role-based computer games.* New York: Teachers College Press.

Spector, J. M., Merrill, M. D., van Merriënboer, J. J. G., & Driscoll, M. (Eds.). (2007). *Handbook of research on educational communications and technology.* Mahwah, NJ: Lawrence Erlbaum Associates.

Squire, K. & Jenkins, H. (2004). Harnessing the power of games in education. *Insight (3)*1, 5-33.

Steinkuehler, C. A. (in press). Cognition and literacy in massively multiplayer online games. In D. Leu, J. Coiro, C. Lankshear, & K. Knobel (Eds.), *Handbook of Research on New Literacies*. Mahwah NJ: Lawrence Erlbaum Associates. Retrieved June 18, 2006, from http://website.education.wisc.edu/steinkuehler/papers/SteinkuehlerNEWLIT2005.pdf

Stone, S. (2006, May). Millennials seek balance, continuing education. *Chief Learning Officer (CLO) Online*. Retrieved May 16, 2006, from http://www.clomedia.com

Suchman, E. A. (1967). *Evaluative research: Principles and practice in public service action programs*. New York: Russell Sage Foundation.

Tallent-Runnels, M. K., Thomas, J. A., Lan, W. Y., Cooper, S., Ahern, T. C., Shaw, S. M., & Xiaoming, L. (2006). Teaching courses online: A review of the research. *Review of Educational Research, 76*(1), 93-135.

Tapscott, D. (1998). Growing up digital: The rise of the net generation. New York: McGraw Hill.

Twenge, J. M. (2006). *Generation me: Why today's young Americans are more confident, assertive, entitled -- and more miserable than ever before*. New York: Free Press.

Underwood, C. (2007).*The generational imperative: Understanding generational differences in the workplace, marketplace, and living room*. Charleston, SC: BookSurge Publishing.

VanDeventer, S. S., & White, J. A. (2002). Expert behavior in children's video game play. *Simulation & Gaming, 33*(1), 28-28.

Vrasidas, C. (2000). Constructivism versus objectivism: Implications for interaction, course design, and evaluation in distance education. *International Journal of Educational Telecommunications, 6(4),* 339-362.

Wolf, M. J. P., & Perron, B. (Eds.). (2003). *The video game theory reader*. New York: Routledge.

Zaslow, J. (2006, May 6). A new generation gap: Differences emerge among women in the workplace. *The Wall Street Journal*, D1.

Zemke, R., Raines, C., & Filipczak, B. (2000). *Generations at work: Managing the class of veterans, boomers, x-ers, and nexters in your workplace*. New York: AMACON.