

University Students of Tomorrow: Changing Experiences, Changing Expectations, Changing Brains

Neal F. Grandgenett and

Neal W. Topp

Abstract

The rapid pace of technological change is becoming a catalyst to a growing group of college students who are essentially “digital natives.” Metropolitan universities need to become aware that these students have considerably different experiences, expectations, and even brains than past students. Universities must carefully adjust their programs and teaching methods if they are to retain these students and prepare them for a digital society. This article describes the basis for this call to action.

“Tim was so learned, that he could name a horse in nine languages. So ignorant, that he bought a cow to ride on.” – Benjamin Franklin

As the famous quote from Benjamin Franklin illustrates, successfully matching the formal educational process to the learning needs of the student has always been a significant challenge in higher education. In today’s world, this challenge is perhaps even greater due to the amazing pace of change within our modern times. Our use of technology is one of the most notable examples of the rapid changes that we are experiencing. To see this “remarkable” pace of change, one simply needs to look around and note the advances we are experiencing in such areas as cell phone technologies, laptop computers, the Internet, and various “smart” electronic devices such as cable and satellite television interfaces. However, if we look a bit more carefully, we may notice additional changes that are even more remarkable and those are changes in students themselves. College students attending our institutions today are quite at home in this new digital world, an environment in which they grew up. However, as their instructors, we grew up in a substantially different environment and we are still just getting used to this digital world. As suggested by Prensky, the students of today are “digital natives,” while we, their faculty, are more typically “digital immigrants” (2001). In essence, we are working with students from a remarkable new culture, that of a “digital society.”

Those of us who are faculty members within a metropolitan or urban university are relatively familiar with the general need for educational institutions to educate students from a variety of backgrounds and cultures. Our metropolitan setting makes that

institutional goal an almost natural “given” that has evolved from the diversities within the cities that we reside. We have department, college, and even university-wide meetings where we routinely follow and report upon the racial, socioeconomic, and gender sub-groupings of our students and attempt to derive implications for our instruction. This would seem to be a worthy goal, for what would be the effectiveness of a metropolitan institution if it does not carefully attune itself to the demographics of its metropolitan area? Research has clearly shown colleges and universities, particularly metropolitan ones, excel best, when they are carefully attentive to the community in which they reside (Gayle, Tewarie and White 2003).

Although institutions of higher education have probably become consistently better at recognizing the changes needed to address the evolving demographics of their student population (such as increasing the diversity of faculty), they have been less quick to understand and address the changing abilities, experiences, and preferences of their students related to technology. Today this need would seem to be a pressing one for the faculty of a metropolitan college or university. In other words, as we begin to better understand these “digital natives” now entering our classes, we may well see that we ourselves, as faculty “immigrants” to this digital world, have a relatively urgent need to adjust our instruction and our institutions to better serve the true needs of our students.

The Changing Experience of Our Students

Our society has come a long way from the days of Benjamin Franklin when technology was as basic as a horse and wagon. It would seem that the rate of change in technology today is only accelerating. Computer technology is probably entering what has been called the “third wave” of technology, in which computers become very pervasive and recede into the very background of our lives (Kaput 2000; Weiser 1991, 1994). In this projected third wave of change, we are rapidly evolving from a society without computers, to sharing single large computers or mainframes (the first wave), to having a personal computer for each person (second wave), to having different types and embedded uses of computers for each person (third wave). Many of these embedded uses of computers are common in devices such as televisions, cell phones, and hand-held computing devices such as Global Positioning Systems (Savill-Smith and Kent 2003). In many of these devices computers are well integrated and almost transparent. Technology is all around and technology-users are becoming just as prevalent. We have begun to observe this third wave of technology use as represented by the technology-adept students enrolling at the University of Nebraska at Omaha (UNO).

UNO is a metropolitan university in Omaha. The Omaha metropolitan area is relatively large, extending across four Nebraska counties — Douglas, Sarpy, Cass and Washington — and in many ways, includes the city of Council Bluffs, just across the Missouri river in Pottawattamie County, Iowa. This five-county metropolitan area has a population of 734,270 and is the 61st largest metropolitan statistical area in the United States. It contrasts sharply with the remainder of the relatively rural state of Nebraska.

Nebraska has approximately 1,739,291 people within 76,872 square miles for an average of roughly 22 people per square mile (U.S. Census Bureau 2003). Within the 50-mile radius of Omaha resides a population of more than one million (Omaha Chamber of Commerce 2004).

UNO's enrollment in the fall semester of 2005 included more than 12,000 undergraduate students and more than 3,000 graduate students. Educational technology has been very popular at our institution where more than 70 percent of all courses now include an online component of some type (such as using Blackboard). This trend of embracing technology also generally is true of the rest of Nebraska, since the state was one of the first to fully embrace the use of the Internet as a basic tool for education. In fact, as early as 1998, Education Week listed Nebraska as a top state for the use of the Internet within the United States.

As in many institutions across the country, and as any aging faculty member might attest, the life experiences of the UNO students today have been considerably different from many of our experiences as faculty. These young "digital immigrants" have lived in a world being permeated by technology. The extensiveness of the technology experiences of young people has been a national phenomenon. Researchers, such as Wurman (2000), and Jukes and Dosaj (2004) have attempted to quantify some of these experiences. Jukes and Dosaj reference that today's high school graduate has typically played more than 1,000 hours of video games, watched more than 20,000 hours of television, and talked on the phone more than 20,000 hours. By contrast, these students have received roughly 11,000 hours of formal schooling. Researchers are beginning to believe that such technology-based experiences have made an impact in the way such students think and learn. As stated by Jukes and Dosaj:

"The bottom line is that kids today are FUNDAMENTALLY different than previous generations in the way they think, in the way they access, absorb, interpret, process and use information and above all, in the way they view, interact and communicate in the modern world." (2004: Pg. 2).

Survey research referenced from the large PEW Internet Report yields some interesting contrasts concerning the use of technology by young people and that of their older parents. For example, this report found in 2004 that young people were significantly more online than adults (78 percent for ages 12-17 versus 63 percent for all Americans). Young people consistently sought electronic entertainment (82 percent play videogames regularly) and they were quite likely to use the Internet to assist with school homework (94 percent). Not surprisingly, for adults who had such computer-savvy children in their households, the presence of such young people possibly encouraged an increased computer use of the adults who lived with them, as reflected by survey results that found 73 percent of parents used technology regularly, as opposed to 57 percent of non-parents.

Young college students coming from such computer rich households quite possibly will turn out to be the most experienced technology users in our society. Researchers

such as Jones have suggested that college students are particularly Internet-connected (2002). Jones and other researchers conducting a large-scale survey project entitled “The Internet and American Life” reported that 86 percent of college students were consistently online compared with 59 percent of the regular population. Much of these college students’ communication with peers and extended family was by e-mail, with 72 percent reporting that they checked e-mail at least once a day. The great majority of these college students also owned their own computer (85 percent) and 66 percent of these students used at least two e-mail addresses. Finally, a large majority of the college students surveyed saw their technology use, and particularly their use of the Internet, to be directly connected to their academic needs as a student in college. The survey results indicated that 79 percent of the college students agreed that their Internet use had a positive impact on their academic efficiency and effectiveness.

In the Omaha area, such consistent college-aged technology users may well have gained considerable technology experience within their K-12 educations. Due to the typical ages of the students served, K-12 schools have had to address the changing technology backgrounds of their students even earlier than institutions of higher education. In our metropolitan area, we believe that the use of educational technology within the local K-12 districts has actually been a considerable catalyst to the use of technology by students at UNO. Omaha has more than 98,000 K-12 students in 188 public school buildings, and most have considerable technology access in those classrooms. Local school districts have reported substantial K-12 computer use, with 100 percent of the buildings having computer labs, and 99.4 percent of the classrooms having a functioning Internet computer (The Metropolitan Omaha Education Consortium 2004). The general student to computer ratio in the area is an impressive 2.8 students to school computer. In addition, one high school has even issued laptops to all students, with impressive changes projected in the curriculum to more fully utilize the power of the technology. Also, five fourth grade classes in the area have programs in which computer laptops and/or handheld computing devices are provided for each student. Surveys of local households in the area have also documented a considerable use of technology by families, with between 60 percent and 88 percent of the homes having Internet access (Omaha Chamber of Commerce 2004). In essence, many of the students who are coming to UNO today are coming ready to use technology in their university coursework.

The Changing Expectations of Our Students

The expectations of these new college student “digital natives” are also changing along with their background experiences. Informal interactions of students today in the college classroom reveal a bit of a sense of these changing expectations. At our institution, students are becoming less willing to take notes by pen or pencil, less eager to take a “lecture-oriented” class, and more reluctant to buy expensive paper-based textbooks when they can find cheaper “electronic textbooks” on the Internet. Each of these student concerns would seem to be quite reasonable and to some degree partly related to our success with technology at our institution. At UNO, we have attempted to embrace educational technology and such technology expectations of our students

by moving toward a more pervasive computing environment for the instruction of students on our campus. This has been accomplished by doing things such as ensuring that all of our classrooms have computer and video projection capabilities, that students have access to wireless Internet capability across all areas of campus, and that computer laboratories are easily accessible to students. In essence, we have placed a high priority on meeting the changing expectations of our students.

The students themselves sometimes note the difference between the natural inclination of young people to use technology and the seeming contrast of some adults to embrace it. As stated by a college freshman Brad Cox, 18:

“We are the generation that has always experienced technology. It is like we are the link between the primitive ways.... and the advanced form of life.”

In many ways the K-12 school districts use of technology as a teaching and learning tool has helped raise student expectations for a consistent technology use in their college educations. Lenhart, Simon, and Graziano have identified the ways that students and teachers seem to be most impacted by Internet-related technology in middle school and high school (2001). These ways consist of online study aids, research for papers and projects, instant messaging on homework to receive help from other students, websites about school or classes, and websites as schoolwork. It would seem their teachers tend to agree that Internet-related technology is very important to a student’s education today, with 96 percent saying that the use of the Internet was an essential component of educational communication (pg. 4).

In our metropolitan institution, we would agree that the expectations of our college students are high when it comes to experiencing the use of technology within their learning and that some of these expectations have grown from their strong experiences in the K-12 school environments. The use of educational technology by the Omaha Public Schools (OPS) is a good example of the relatively strong uses of technology within the area’s K-12 schools in which every classroom has an Internet connected computer. OPS is a very diverse school district, and in fact, OPS educates the majority of Nebraska’s minority populations. Nearly 80 percent of Nebraska’s African American students, 60 percent of the state’s Hispanic American students, and 35 percent of the state’s Native American students are enrolled in Omaha schools. In OPS, at least 40 languages are spoken (OPS 2005). OPS is also a district that has embraced extensive use of educational technology as one of its key strategies to help effectively educate this diverse population.

We have observed some impressive uses of educational technology in OPS and our other K-12 school districts. For example, all of the schools in our area use some sort of formal web-based communication process with students whereby teachers post assignment descriptions, homework help notes, and even grade related feedback. Within this website context a student typically goes on line to receive some assignment related handouts and directions from teachers and may well go periodically to the website to check on grades for particular assignments and courses. Some districts have

formalized this communication process even more, using packages such as “PowerSchool.” This program keeps a careful “real-time” record of student absences, tardiness, grades, and assignments and can be checked frequently by both student and parent. Another administrative tool common in our area schools is the use of handheld computing devices for student notes, schedules, student information and in some cases the students’ pictures.

Electronic portfolios also are becoming relatively common at the schools with periodic assistance from the UNO College of Education. These ePortfolios use authentic assessment techniques, which include focusing on what students can do, as well as what they know. These ePortfolios encourage instructional techniques that use active learning, project-oriented learning, infusion of several disciplines, and transfer of knowledge to new situations (Darling-Hammond and Bransford 2005). The ePortfolios help students see the impact of their coursework on their academic progress as they acquire and can show their competencies of identified important skills. This type of assessment encourages “deep understanding” rather than “surface knowledge,” and is a key recommendation in *How People Learn* by Bransford (2000). In addition, the ePortfolio systems use a variety of media in addition to text, such as digital movies, graphics, sound, and concept mapping files.

We also have observed some impressive uses of communication-related educational technology that is striving to “break down the walls” of the classrooms within our local K-12 schools. For example, in several local middle schools, there is a national program sponsored by NASA called EarthKam, which allows students to actually control digital cameras on the NASA Space Station. These students target images with NASA’s high-resolution cameras and then download those images to their computer through the Internet. The activity is very rich in mathematics and science as the students interpret the images of various features, such as lowland flooding, prairie fires, and erosion (for more information see <http://www.earthkam.ucsd.edu/>).

The use of digital video is also a good example of the instructional technology innovations underway in K-12 school districts. In the Omaha area, we have K-12 students routinely doing projects with iMovie and similar digital video software packages in several of their classes. A variety of disciplines and teachers seem to have embraced this media, as students design video projects to illustrate their understanding of various historical events. Some examples include: a high-school student’s video documentary on the Flu Pandemic; a middle school student’s overview of a local artist’s work; and a group of elementary students’ video on tessellations for their fourth grade mathematics class. These K-12 digital natives are learning to communicate their ideas in a variety of ways beyond the traditional essay, which may well encourage a desire and expectation to use such technology for communicating their ideas within their college coursework.

The changing expectations of students at a college or university can, and probably should, have some implications for that institution’s learning environment. In considering the “next generation” of learners and the related implications for college and university leaders, the American Association of State Colleges and Universities published a 2004 report called *The Key to Competitiveness: Understanding the Next Generation of Learner* which outlines some of the institutional implications related to these new college students. The following chart from that document maps five student characteristics to potential institutional implications (pg. 5).

New Generation “Student Characteristics” that Suggest Implications for Institutions	
<i>Student Characteristic</i>	<i>Potential Implication</i>
Increasing importance of out-of-class experience.	Attention needs to be paid to the design of informal spaces.
High level of comfort with collaboration.	Attention needs to be paid to the design (or redesign) of classroom space.
Net geners feel that the online world is a community but they value the face-to-face experience in courses.	Attention should be paid to what components of the course experience leverage online and face-to-face activity.
Need for mobility.	Invest in wireless systems to satisfy student need to be able to access courses, communities, and resources from anywhere.
Desire for customer service.	Adult students in particular have specific learning needs and objectives and a high level of expectation that their academic and business needs be met efficiently.

For metropolitan universities dependent on the ongoing attendance of students from a local metropolitan area, the need to meet the changing expectations of our digital native students is of critical importance. These students, like no other students in the past, are not limited by location. They will easily be able to adapt to and embrace online courses from institutions all over the country. This competition for students is already being felt by UNO, and no doubt by most metropolitan universities, where online programs from institutions outside of our metropolitan area are being heavily marketed and advertised within their service area. So far, our student base is intact and growing, but the increased competition does not go unnoticed by our students, administration, or faculty.

The Changing Brains of Our Students

The “digital natives” who are continuing to grow in numbers on our metropolitan campuses are not only different from many of us in their technology experiences and expectations, but their brains may actually be a bit different. Medical researchers have long been impressed with just how remarkable the human body is in its general adaptability. We heal when cut, tan when sunburn, and run a fever to fight infection. Each of these changes in our body happens remarkably quickly, with relatively small amounts of general input or information coming through our internal and external senses. Brain researchers are beginning to believe that this part of our body may perhaps be the most adaptable of all, particularly in how we learn and the impact of our learning on mental structures (Erlauer 2003; Sousa 2001, 1998).

A review by Prensky (2001) suggests that digital natives already have brain structures that differ significantly from the faculty members who teach them. Prensky’s review details three aspects of the emerging research on the brain that education can probably now take as givens. These include: 1) the brain is reorganized through life, 2) stimulations and inputs change brain structures over a period of time, and 3) different developmental experiences impact how people think. Building on this “malleability” of the brain, it also appears that the “digital natives” of today essentially are in the process of developing what might be considered to be “hypertext minds” that generally work with information almost like any one of us might scan or use a web page. A hypertext mind looks for connections and relevance to information, and when that relevance is not present, it quickly moves onto other sources of information (or in this example, other web pages). This idea of a “hypertext mind” may also somewhat explain why some more experienced faculty members might note that the “attention span” of their students appears to be so much shorter than that of students in the past. It may well be that when the student of today doesn’t see a direct significance or relevance to the information presented, they don’t give the information much attention (or even much attention to the presenter of that information).

As we interact with the “digital natives” of today and we begin to rethink what makes an effective learning experience, researchers have sought to document the impacts of such immersive technology on our families and their learning (Ehrich and McCreary 1999, Pellegrino 2001, Sousa, 2001). Some interesting contrasts are emerging. For example, the researchers Jukes and Dosaj (2004) have summarized how these new “digital natives,” with their evolving “hypertext minds,” appear to compare with the “digital immigrants” of yesterday. The following table reviews and expands some of these interesting differences (pg. 23).

The Learning Preferences of Digital Natives Versus Digital Immigrants	
<i>Digital Natives</i>	<i>Digital Immigrants</i>
Prefer receiving information quickly from multiple multimedia sources.	Prefer slow and controlled release of information from limited sources.
Prefer parallel processing and multitasking.	Prefer singular processing and single or limited tasking.
Prefer processing pictures, sounds, and video before text.	Prefer to provide text before pictures, sounds, and video.
Prefer random access to hyperlinked multimedia information.	Prefer to provide information linearly, logically, and sequentially.
Prefer to interact/network simultaneously with many others.	Prefer students to work independently rather than network and interact.
Prefer to learn “just-in-time.”	Prefer to teach “just-in-case” (it’s on the exam).
Prefer instant gratification and instant rewards.	Prefer deferred gratification and deferred rewards.
Prefer learning that is relevant, instantly useful, and fun.	Prefer to teach to the curriculum guide and standardized tests.

Such contrasts between digital natives and digital immigrants may have considerable implications for what has been often termed as the “digital divide,” especially as our schools and universities start to adapt to the new learning needs of the digital natives (Tinker and Vahey 2002). Students who do not have the opportunity to regularly access technology and participate in societal technology-based experiences may well find that the institutions of learning are even less familiar to them as these institutions evolve. Universities, colleges, public schools, and other societal organizations will need to help these students keep pace with technological advances or risk further losing these individuals to society.

Society is indeed in a state of change, and it is not only the brains of our young people that may be changing, but also our language within that society. Many new words, based on technology, are now entering the vocabulary of our daily language. These words include terms such as blogs, iPods, Google, wikis, on-line, ePortfolios, PDA,

and webquest. One only needs to thumb through the newest versions of Webster's dictionary to get a sense of these changes in our language and how these changes reflect a society experiencing considerable and rapid changes in its technology.

New research on preparing teachers for a changing world, sponsored by the National Academy of Education, is more closely aligning what we have learned about the brain and how people learn with how educational institutions might better adjust their learning environments (Darling-Hammond and Bransford 2005). The many misconceptions about human "intelligence" and brain development that helped encourage traditionally very passive and "track oriented" learning environments are now falling away; and more dynamic, collaborative, and flexible learning environments that are more compatible with how students truly think and learn are becoming more typical. However, as suggested by the American Association of State Colleges and Universities, it is up to the institutions themselves, to recognize "the kind of enterprisewide change necessary to break down old ways of doing business [and that it] requires leadership, new organizational structure, and constant measurement." (2004: pg. 5)

Taking the Institutional "Fork in the Road"

Considering the evolving changes in the experiences, expectations, and even perhaps brains of our students, where do metropolitan universities go from here? How do we thrive and embrace the future when considering the growing percentage of students who are "digital natives?" The famous baseball player and sometimes philosopher, Yogi Berra, once said, "When you come to a fork in the road, take it." Metropolitan institutions may well be coming to a "fork in the road" representing how we plan and deliver instruction at our institutions. We may need to take that fork in the road with little hesitation. Digital natives, with their technological sophistication, may need a different set of learning experiences than we faculty had in our own college experiences. These students also have a growing number of educational options existing outside of our institutional area, such as online courses, and without our careful institutional growth and evolution, we could easily lose these students to those other options.

As two faculty members who have been following this phenomenon for several years and after considering our own personal "forks in the road," we recommend the following eight ways of encouraging institutional success with digital natives. Many of these recommendations are based on the successes and innovations of our own university, as it has energetically tried to provide "digital natives" with the best education possible. We suggest:

- 1) First and foremost, our metropolitan universities must build the awareness that the students coming to us today may well be fundamentally different than the students of the past. At our institution, we are conducting faculty presentations, teaching circles (small group seminars), brown-bag lunches, and other strategies to help build this awareness.

- 2) Metropolitan institutions will want to put a priority on educational technology use within coursework and programs and also on the critical thinking skills associated with such technology use. At our institution, educational technology use is an ongoing priority for faculty training, equipment purchases, and program planning. There is also a growing focus on coursework that builds on the critical thinking skills of such technology use, such as information fluency, visual fluency, team building and communication.
- 3) Online course options, for some classes or competencies within a program, would seem to be an important way to address the preference of digital natives for online experiences. At our institution, many of our faculty members are being encouraged to develop online course components or even fully online classes. In addition, development stipends are sometimes available to faculty to help encourage a careful planning and transition process.
- 4) Institutions of higher education need to aggressively plan for a “pervasive and ubiquitous” computing environment on campus. Our institution has been careful to reflect this goal with wireless networked buildings, extensive computer labs and various workstation kiosks across campus. In addition, online environments for course registration, tuition payment, library services, program enrollment, and many other campus services may not only be more efficient for delivering such services, but may also better reflect the considerable operational expectations of digital native students.
- 5) EPortfolios or similar types of assessments need to be implemented. Students want to know that assessments are relevant and show not only what they know, but also what they can do. Also, students need to see how the knowledge and skills they acquire in their coursework and outside the classroom fit together and are relevant to their future. In addition, ePortfolios can help the institution measure and communicate the progress of its students, faculty, and campus. UNO has implemented an ePortfolio initiative that includes student, faculty, and campus ePortfolios. By having a comprehensive ePortfolio project, the institution is developing an “ePortfolio culture,” designed to focus the attention on outcomes, rather than inputs.
- 6) The relevance of courses and programs need to be carefully considered by our institutions, since it is being carefully considered by our students. Metropolitan universities have been long adept at collaborating with our communities for the development of courses that are well connected to community needs. We need to more aggressively embrace such collaboration. We have found that university initiatives such as service learning opportunities, business collaborations, and innovative field experiences are growing in their institutional importance. Students also seem to be asking more thoughtful and direct questions related to the courses that they are required to take within their programs.

- 7) The death of the “university lecture” cannot come soon enough and may well need to be both encouraged and embraced at an institution. Metropolitan institutions have always had a special goal for providing “relevant” education to our students. At UNO, we are finding that the courses of the traditional lecture prone instructors are simply becoming the sections that are less likely to be filled. Faculty members at UNO are provided with various in-service or training activities to help upgrade their instruction and are consistently invited to various informal sharing sessions on how they might improve their instructional techniques.
- 8) The strategic planning process for an institution should focus on future student needs rather than on current student needs. With the rapid pace of change that we are experiencing as a society, a university’s strategic planning process is becoming especially important for an institution. However, a strategic planning team must be careful to truly consider the future needs of their students rather than simply defining current needs. In other words, a burning planning issue today, such as a lack of space within the bookstore, may in fact be a relatively minor planning issue when considering future students and their needs related to a pervasive computing campus. At UNO, the strategic planning sessions have always been carefully initiated with a formal review of the projected demographics of our future students, as well with presentations of various professionals contributing thoughts related to the changing experiences and expectations of our university students of tomorrow.

Although it may not be fully clear which way to go, it is relatively clear that the “fork in the road” is indeed upon us as metropolitan universities and other institutions of higher education. How we effectively accommodate these new digital natives arriving on our campus may well decide if we will continue to grow and support our community, or even exist at all.

To truly embrace the kind of institutional changes that it will take to move forward effectively as a metropolitan campus, it is not enough to just have good leadership “at the top” that understands the changing landscape of student experiences, expectations, and brains. Such leadership is of course important, but such leaders cannot undertake such fundamental changes at an institution alone. Faculty, staff, and even the students themselves need to be made aware of, and even plan for, a more dynamic, flexible, collaborative and interactive learning environment. As summarized by the American Association of State Colleges and Universities:

“While the fundamental mission of the university hasn’t changed, the world around it is changing. Evidence of that change is most visible in students, both in terms of demographics as well as their perceptions and expectations. When we stop meeting students needs, or when we cling to [old] assumptions about what is necessary in an educational environment, we compromise our value.” (2004: pg. 15).

If metropolitan universities are to exist and hopefully thrive within a society of pervasive and ubiquitous computing, where computer technology is woven into the very fabric of society, then the university classroom itself must also reflect that

interwoven fabric. Most importantly, we must truly stay in tune with the society and communities that we support. Otherwise we run the considerable risk of not preparing our students to learn, work, and thrive within our society. As Benjamin Franklin suggested, we run the risk of being a very ineffective educational institution that encourages our students to select cows to ride upon, when they really need a horse.

References

American Association of State Colleges and Universities, *The Key to Competitiveness: Understanding the Next Generation Learner* (Washington: EDUCASE, 2004).

Bransford, J. et al., *How People Learn: Brain, Mind, Experience, and School* (Washington: National Academy Press, 2000).

Darling-Hammond, L., and J. Bransford, *Preparing Teachers for a Changing World* (San Francisco: Jossey-Bass, 2005).

Ehrich, R.W., and F. McCreary, "Immersive Educational Technology: Changing Families and Learning." Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada, April 19-23, 1999.

Erlauer, L., *The Brain-compatible Classroom: Using What We Know about Learning to Improve Teaching* (Arlington, VA: Association for Supervision and Curriculum Development, 2003).

Gayle, D. J., B. Tewarie, and A. Q. White, "Governance in the 21st Century University: Approaches to Effective Leadership and Strategic Management," ERIC Digest No. ED 482560 (Washington: ERIC Clearinghouse on Higher Education, 2003).

Jones, S., "The Internet Goes to College," a PEW Internet and American Life Project Report (Washington, 2002).

Jukes, I., and A. Dosaj, *Understanding Digital Kids: Teaching and Learning in the New Digital Landscape* (Kelowna, British Columbia: InfoSavvy Group, 2004).

Jukes, I., and T. McCain, "Learning in the New Digital Landscape (Windows on the Future)." A keynote at the National Educational Computing Conference, Seattle, WA, 2003.

Kaput, J.J., "Implications of the Shift from Isolated, Expensive Technology to Connected, Inexpensive, Diverse and Ubiquitous Technologies." Proceedings on the International Conference on Technology in Mathematics Education, Auckland, New Zealand, 2000.

Lenhart, A., "Teens, Parents, and Internet Technology." A presentation made to the Lawlor Group Summer Seminar, Minneapolis, MN, 2004.

Lenhart, A., M. Simon, and M. Graziano, *The PEW Internet and American Life Project Report 2001* (Washington: PEW Internet and American Life Project, 2001).

Metropolitan Omaha Education Consortium, Member School District Statistics (Omaha, NE: Metropolitan Omaha Education Consortium Website, 2004). (Electronic report at <http://coe.unomaha.edu/moec/>).

Omaha Area Chamber of Commerce, *Quick Facts about Omaha* (Omaha, NE: Omaha Area Chamber of Commerce Economic Development Webpages, 2004). (Electronic report at <http://www.accessomaha.com/>).

Omaha Public Schools, *Omaha Public Schools Research and Statistics* (Omaha, NE: Omaha Public Schools Webpage, 2005). (Electronic report at <http://www.ops.org/research/>).

Pellegrino, J.W., *Rethinking and Redesigning Education Assessment: Preschool Through Postsecondary* (New York: Metropolitan Life Foundation Change in Education Initiative, 2001). ERIC Document No. ED 456136.

Prensky, M., "Digital Natives, Digital Immigrants Part 1," *On the Horizon* 9 (September/October, 2001): 1-6.

Prensky, M., "Digital Natives, Digital Immigrants Part 2," *On the Horizon* 9 (November/December, 2001): 1-8.

Rideout, V., D. F. Roberts, and U.G. Foehr, "Generation M: Media in the Lives of 8-18-Year-olds," (A Kaiser Family Foundation Study, Menlo Park, CA, 2005).

Savill-Smith, C., and P. Kent, *The Use of Palmtop Computers for Learning: A Review of the Literature* (London, United Kingdom: Learning Skills Development Agency, 2003).

Sousa, D., *How the Brain Learns* (Thousand Oaks, CA: Corwin Press, 2001).

Sousa, D., "The Ramifications of Brain Research," *School Administrator* 55 (1, 1998): 22-25.

Tinker, R., Vahey, P., "Ubiquitous Computing: Spanning the Digital Divide," *Journal of Science Education and Technology* 11 (3, 2002): 301-304.

U.S. Census Bureau, "Nebraska Quick Facts" (Washington: U.S. Census Quick Facts Webpage, 2003). (Electronic report at <http://quickfacts.census.gov/qfd/states/31000.html>).

Weiser, M., "The Computer for the 21st Century," *Scientific American* (September 1991): 94-110.

Weiser, M., "The World is Not a Desktop," *Interactions* (January 1994): 7-8.

Wurman, S., *Information Anxiety 2* (Indianapolis: Que Publishing of Pearson Education, 2000).

Author Information

Dr. Neal F. Grandgenett is the Peter Kiewit Distinguished Professor in the Department of Teacher Education at the University of Nebraska at Omaha and is active in the examination of technology-based learning environments with over 70 articles and research papers related to the topic. He is a frequent evaluator of national projects, having evaluated almost 20 projects for the U.S. Department of Education, NSF, NASA, the National Academy of Sciences, and various other national, state, and private agencies.

Dr. Neal W. Topp is the Varner Distinguished Professor of Education in the Department of Teacher Education and the director of the Center for ePortfolio Based Assessment at UNO and has published more than 60 papers and articles related to educational technology, authentic assessment and new learning environments. He routinely presents at national conferences, including National Educational Computing Conference (NECC), Society for Technology in Teacher Education (SITE), and is a well-known evaluator of federally funded education projects.

Neal F. Grandgenett, Ph.D.
Peter Kiewit Distinguished Professor
College of Education - Kayser Hall 107
University of Nebraska at Omaha
Omaha, NE 68182
E-mail: ngrandgenett@mail.unomaha.edu
Telephone: (402) 554-2690
Fax: (402) 554-3744

Neal W. Topp, Ph.D.
Varner Distinguished Professor
College of Education - Kayser Hall 314F
University of Nebraska at Omaha
Omaha, NE 68182
E-mail: ntopp@mail.unomaha.edu
Telephone: (402) 554-2435
Fax: (402) 554-3744