21st Century Education, Technology, and the Role of Distance Education

Introductory Remarks

Education delivery methods continue to evolve in America and the world. Applied instructional theory now sees more and more integration of the tools of information technology ("IT meets IT"). As a result we are seeing challenges to so-called traditional pedagogical approaches. While the classroom is no stranger to change, the rate of change brought on by an inundation of advances in information technology and high-speed telecommunications services is a significant catalyst in the discussion over what to do and what not to do.

Educators should not feel alone in this sea of change awash with the opportunities afforded by technological innovation. Retail, healthcare, manufacturing, transportation and numerous other sectors experience this same challenge and share many similar issues of planning and absorption.

Yet it's not merely technology that is spurring change. The students and businesses that drive the marketplace in our consumer-oriented society are demanding more and more from their educational institutions. We might also add for less and less cost. How will we meet increased demands by populations forever increasing needs for education and skills transfer? How do we ensure the opportunities of education are available to all who want and need them? How we ride the waves of constant and rapid change will have everything to do with our abilities to meet the demands of students of all ages in every location.

Distance education using digital technologies and telecommunications will play a crucial role in meeting the demands for anytime, anywhere education in the 21st century. However, it's not a "one size fits all" proposition.

Distance Education Defined

Several definitions have emerged.

> "Distance Learning (DL) is an instructional delivery system which connects learners with educational resources. DL provides educational access to learners not enrolled in educational institutions and can augment the learning opportunities of current students. The implementation of DL is a process which uses available resources and will evolve to incorporate emerging technologies."[1]

> "Distance education is planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements".[2]

> "The process of extending learning, or delivering instructional resource-sharing opportunities, to locations away from a classroom, building or site, to another classroom, building or site by using video, audio, computer, multimedia communications, or some combination of these with other traditional delivery methods."[3]

> "The acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance."[4]

> "Distance education is instruction that occurs when the instructor and student are separated by distance or time, or both."[5]

6570 Old Stage Road Central Point. OR 97502 (541) 664-2456 john@jirwinconsulting.com www.jirwinconsulting.com

"Distance learning is a term which encompasses all learning that takes place at locations remote from the point of instruction. It is an option for beginning studies or continuation of study off-campus in locations via cable television, Internet, satellite classes, videotapes, correspondence courses, or by other means. Distance learning integrates technology in educational courses whereby students may view and participate in lectures from various locations, or on an individual basis. Various forms of computer-based communication may be used to facilitate class discussions and communication among faculty and students. Distance learning may take the forms of an instructor-led course delivered via satellite to traditional home study correspondence courses, which is viewed by the hierarchy in education as still the most effective practice which wields the highest course grades, in short, results."[6]

"Trying to define distance education is rather like trying to define art of science…we all have a sense of what it is when we see it but would be hard pressed to accurately define it. Learners and teachers are separated by geography and or time."[7]

"Distance education is any type of learning where students and instructor are separated by time and/or place. It can be delivered using a variety of methods or technologies including modem/on-line computer, videotape, public broadcasting, satellite, or other media. Southwestern offers distance education by modem/on-line computer instruction through Southwestern On-Line and through a consortium, OCCDL, over the Internet, as well as selected telecourses and teleconferences through Ed-Net satellite."[8]

No matter how you define it, distance education is part of a field undergoing fundamental change.

"Although not an old discipline by academic standards, distance education practice and theory has evolved through five generations in its 150 years of existence. For most of this time, distance education was an individual pursuit defined by infrequent postal communication between student and teacher. The last half of the twentieth century witnessed rapid developments and the emergence of three additional generations, one supported by the mass media of television and radio, another by the synchronous tools of video and audio teleconferencing, and yet another based on computer conferencing. The first part of the twenty-first century has produced the first visions of a fifth generation—based on autonomous agents and intelligent, database-assisted learning—that we refer to as the educational Semantic Web. Note that each of these generations has followed more quickly upon its predecessor than the previous ones. Moreover, none of these generations has completely displaced previous ones, so that we are left with diverse yet viable systems of distance education that use all five generations in combination. Thus, the field can accurately be described as complex, diverse, and rapidly evolving.

However, acknowledging complexity does not excuse inaction. Distance educators, students, administrators, and parents are daily forced to make choices regarding the pedagogical, economic, systemic, and political characteristics of the distance education systems within which they participate. Never in the history of life on our planet has the need for informed and wisdom-filled action been greater than it is today. Distance education is a discipline that subsumes the knowledge and practice of pedagogy, of psychology and sociology, of economics and business, of production and technology.

As we enter the twenty-first century, the world is in the midst of a great turning as we adopt and adapt to the technological capabilities that allow information and communication to be distributed anywhere/anytime. Education is one of the few sustainable means to equip humans around the globe with the skills and resources to confront the challenges of ignorance, poverty, war, and environmental degradation. Distance education is perhaps the most powerful means of extending this resource and making it accessible to all."[9]

6570 Old Stage Road Central Point. OR 97502 (541) 664-2456 john@jirwinconsulting.com www.jirwinconsulting.com

21st Century Education and Digital-Age Proficiencies

Distance education is a Digital Age mechanism for distributing education. As such there are reasonable questions to ponder as we move forward with Distance Education, questions that emerge as we come to a fuller understanding of what is meant by a 21st century education and the challenges we face in meeting this transformation.

To prepare students to thrive in a digital economy they will need Digital-Age proficiencies. It is important for the educational system to make parallel changes in order to fulfill its mission in society. The educational system needs to understand and embrace the 21st-century skills within the context of rigorous academic standards.

It's a "good news, bad news" story.

> "First, the good news: in the years ahead, the declining cost of computation will make digital technology accessible to nearly everyone, from inner-city neighborhoods in the United States to rural villages in developing nations. These technological advances have the potential to fundamentally transform how and what people learn throughout their lives. Just as advances in biotechnology made possible the "green revolution" in agriculture, new digital technology can make possible a "learning revolution" in education.
>
> Now, the bad news: while digital technology could make a learning revolution possible, it certainly does not guarantee it. Early results are not encouraging. In most places where digital technology is used in education, it is used simply to reinforce outmoded approaches to learning. Even as scientific and technological advances are transforming agriculture, medicine, and industry, the ideas and approaches to teaching and learning remain mostly unchanged. To take full advantage of new technology, we need to fundamentally rethink our approaches to learning and education and our ideas of how new technology can support them."[10]

In the last decade, the federal, state, and local governments have invested over $40 billion to put computers in schools and connect classrooms to the Internet. Results are positive related to hardware and connectivity. The percentage of schools connected to the Internet rose from 35 percent in 1994 to 99 percent in 2001. The student to Internet connected computer ratio has improved dramatically in an even shorter time frame, going from 12 students per computer in 1998 to five to one in 2001. Many students who do not have computer and Internet access at home at least have some access at school. However, there are indications that many schools are not using this new infrastructure to maximum advantage.[11]

Michael Resnick in a paper "Revolutionizing Education in the Digital Age" shares the following assessment:

> "Education and learning are often considered in terms of information: What information is most important for people to know? What are the best ways to transmit that information from one person (a teacher) to another (a student)? What are the best ways to represent and display information so that it is both understandable and learnable? It's not surprising that people see a connection between computers and education. Computers enable transmission, accessibility, representation, and manipulation of information in many ways. Because education and computers are both associated with information, the two seem to make a perfect marriage. This focus on information, however, is limiting and distorting, both for education and for computers. If we want to take full advantage of new computational technology and help people become better thinkers and learners, we need to move beyond these information-centric views of computing and learning.

Over the past 50 years, psychologists and educational researchers, building on the pioneering work of Jean Piaget have come to understand that learning is not a simple matter of information transmission. Teachers cannot simply pour information into the heads of learners. Rather, learning is an active process in which students construct new understanding of the world around them through active exploration, experimentation, discussion, and reflection. In short, people don't *get* ideas; they *make* them.

Despite the common use of the phrase "information technology," or IT, computers are more than simply information machines. Of course, computers are wonderful for transmitting and accessing information. Furthermore, they are a new medium through which people can create and express themselves. If we use computers to simply deliver information to students, we will fail to take advantage of the revolutionary potential of new technology for transforming learning and education.

It is through design activities that computers offer the greatest new learning opportunities. Research has shown that many of the best learning experiences come when engaged in designing and creating things, especially things that are meaningful either to us or to those around us. Computers can also be used as a "material" for making things -- and not just by children, but by everyone. Indeed, the computer is the most extraordinary construction material ever invented, enabling people to create a variety of things, from music videos to scientific simulations to robotic creatures. Computers can be seen as a universal construction material, greatly expanding what people can create and what they can learn in the process.

Unfortunately, most people don't use computers that way today. When people are introduced to computers, they are typically taught how to look up information on the Web, how to use a word processor, and how to send e-mail. But they don't become *fluent* in the technology.

What does it mean to be digitally fluent? Consider the analogy with learning a foreign language. If someone learned a few phrases so that he could read menus in restaurants and ask for directions on the street, would you consider him fluent in that language? Certainly not. That type of phrase-book knowledge is equivalent to the way most people use computers today. This knowledge is useful, but it is not fluency. To be truly fluent in a foreign language, one must be able to articulate a complex idea or tell an engaging story. In other words, one must be able to "make things" with language. Similarly, being digitally fluent involves not only knowing how to use digital technology, but also knowing how to construct things of significance with digital technology. Fluency with language not only has great utilitarian value in everyday life, it also has a catalytic effect on learning. When one learns to read and write, one is in a better position to learn many other things. This is also true with digital fluency. In the years ahead, digital fluency will become a prerequisite for obtaining jobs, for participating meaningfully in society, and for learning throughout a lifetime."[12]

Schools face the challenge of preparing students to live, learn and work successfully in today's knowledge-based digital society. To do so will require high-performance learning of academic content using 21st-century skills and tools. To accomplish this, schools must become high-performance learning organizations (see footnote for graphic showing components and relationships within a High-performance school system). [13]

The following skill clusters, when considered within the context of rigorous academic standards, are intended to provide the public, business and industry, and educators with a common understanding of -- and language for discussing -- what is needed by students, citizens, and workers in the Digital Age (see footnote for an expanded list of the components of 21st Century Learning).[14]

Digital-Age Literacy
- Basic, scientific, economic, and technological literacies
- Visual and information literacies
- Multicultural literacy and global awareness

Inventive Thinking
- Adaptability and managing complexity
- Self-direction
- Curiosity, creativity, and risk taking
- Higher-order thinking and sound reasoning

Effective Communication
- Teaming, collaboration, and interpersonal skills
- Personal, social, and civic responsibility
- Interactive communication

High Productivity
- Prioritizing, planning, and managing for results
- Effective use of real-world tools
- Ability to produce relevant, high-quality products

Educating the Generations

The first thing to understand is that there is a sea change underway with students. It is not just an "age thing." While understanding the learning styles and perceptions of students is critical to the creation of better and more successful learning environments, a change in student demographics or perceptions is not always followed by changes at the institutional level. The kind of enterprise wide change necessary to break down old ways of doing business requires leadership, new organizational structures, and constant measurement. [15]

Consider the following imaginary student.

> "Each morning, Jason Keene wakes up in his dorm room and peers over at his PC monitor to see how many IMs arrived while he slept. Sometimes more than 15 attempts to reach him are visible on the screen, along with various postings to the blog he's been following since the semester began in January. After a quick trip to the shower, the sophomore computer science major pulls up an eclectic mix of news, weather, sports, and information on the home page he customized using Google. He then logs onto his campus account to see if the previous day's sociology lecture is posted. He notices a reminder that there will be a quiz that day as well as another one letting him know that the paper he's writing needs to be e-mailed to a professor by midnight the next day. With a cup of instant coffee on the desk next to him, Jason IMs a few friends and then pulls up a wiki to review progress a teammate has made on a project they're doing for their computer science class.[16]

The rest of us might be wondering when Jason is going to start his day, but if you ask Jason, he's already halfway through it. Other than the lecture that he may or may not attend—he can download the notes—he's likely to spend most of the morning in his room. By noon, he's sent a text message from his cell phone to a friend to meet him at the Student Union, where most afternoons he can be found sitting with a group of students, laptop poised on his knees, accessing notes, papers, and documents using the campus's wireless network. Back in his room, he's likely to stay up past midnight juggling notes, papers, instant messages, and an Internet-based

multiplayer game he thinks he's almost beaten. He's been to the library once in the two years he's been at college, and he communicates frequently with his professors via e-mail. When it comes to research, he's more likely than not to consult Google and Wikipedia.

Students 18–22 years of age speak primarily about the ways in which they communicate and maintain community but not necessarily about specific technologies. That observation supports much of the current data about college-age students, most of who have grown up with technology and view it, not as a device or application, but as a means for communicating and maintaining relationships. The real news, however, is how little today's college and university leaders know about Jason and his peers, and how that lack of knowledge could be hampering their ability to remain competitive.

NetGeneration and Millennial students

Today's Net Gen college students have grown up with technology. Born around the time the PC was introduced, 20 percent began using computers between the ages of 5 and 8. Virtually all Net Gen students were using computers by the time they were 16 to 18 years of age. Computer usage is even higher among today's children. Among children ages 8 to 18, 96 percent have gone online. Seventy-four percent have access at home, and 61 percent use the Internet on a typical day.[17]

Whether or not students have access to computers and the Internet from home, they consider such access important. When high school students were asked why technology is essential to their education, responses included[18]:

- It's part of our world.
- Technology is so embedded in our society, it'd be hard not to know how to use it.
- It's really helpful -- it makes things faster.
- Abstract concepts are often easier to grasp when technology is used effectively as a teaching tool.
- Some students at my school who weren't great students are better ones now thanks to computers.
- Technology allows us to learn as much as we want to about virtually any topic.
- I usually connect with friends either to get help or to help others.
- By the teenage years, students use the Web extensively for school research (94 percent) and believe it helps with schoolwork (78 percent). Although technology is used heavily, students seem to keep technology in perspective. In their words:
- Teachers are vital to the learning process. Tech is good, but it is not a perfect substitute.
- Computers can never replace humans.
- Learning is based on motivation, and without teachers that motivation would cease to exist.
- A major part of school is building social skills. If we were to always communicate through technology and not in person, then the way we would view life would change dramatically.

The characteristics of traditional age (18-to-22-year-old) college students—a group sometimes called the Millennials -- have been described as individuals who:

- Gravitate toward group activity

- Identify with parents' values and feel close to their parents
- Believe it's cool to be smart
- Are fascinated by new technologies
- Are racially and ethnically diverse; one in five has at least one immigrant parent
- Are focused on grades and performance
- Are busy with extracurricular activities
- When asked about the biggest problem facing their generation, many respond that it is the poor example that adults set for kids.[19]

Individuals raised with the computer deal with information differently compared to previous cohorts: "they develop hypertext minds, they leap around."[20] A linear thought process is much less common than the ability to or piece information together from multiple sources. Among other differences are their:

Ability to read visual images -- they are intuitive visual communicators
Visual-spatial skills -- perhaps because of their expertise with games they can integrate the virtual and physical
Inductive discovery -- they learn better through discovery than by being told
Attentional deployment -- they are able to shift their attention rapidly from one task to another, and may choose not to pay attention to things that don't interest them
Fast response time -- they are able to respond quickly and expect rapid responses in return

Although many observations can be made about the Net Generation, several merit special mention because of the potential impact on higher education.

Nontraditional Students

At the same time that colleges and universities are graduating their first Net Generation learners, most campuses are experiencing an influx of nontraditional students.[21] Three-quarters of all undergraduates are "nontraditional," according to the National Center for Educational Statistics. Nontraditional students are defined as having one or more of the following characteristics:

- Delayed enrollment -- did not enter postsecondary education in the same year they graduated from high school
- Attend part-time, for all or part of the academic year
- Work full time -- 35 hours or more -- while enrolled
- Financially independent as defined by financial aid
- Have dependents, other than a spouse, which may include children or others
- Single parent, having one or more dependent children
- Lack of a high school diploma

The more nontraditional characteristics students possess, the less likely they are to persist in college after the first year or to graduate. Nontraditional learners tend to be concentrated in specific types of institutions. In community colleges, for example, nearly half the students have delayed beginning postsecondary education. Half also had two or more persistent risk factors. In contrast, 91 percent of students in four-year colleges enrolled immediately after high school; 85 percent had no persistent risk factors. Adult learners represent a significant category of nontraditional learners[22]:

- 35 percent of undergraduates are adult learners
- 70 percent of all adult learners are female
- 38 is the median age of undergraduate adult learners
- 80 percent of adult learners are employed

The motivation for going to college is often different for adult learners compared to the Net Gen. Among adult learners 70 percent have a degree as their goal; the other 30 percent are seeking a certificate or a specific set of skills.

It is often said that we see the world through our own eyes. Our experiences and the environment around us shape how we think, behave, and act. Consider birthplace. If you were born in the south, you might have a southern accent; if raised in Canada, you would speak differently. Tastes in food and clothes might differ, as would customs and expressions. We are all products of our environment -- and technology is an increasingly important part of that environment.

Comparing the Generations

Few generalizations are entirely correct. However, generalizations -- such as those about generations -- highlight trends. Today's generations can be described as follows.[23]

Birth Dates	**Matures 1900–1946**	**Baby Boomers 1946–1964**	**Generation X 1965–1982**	**Net Generation 1982–1991**
Description	• Greatest generation	• Me generation	• Latchkey generation	• Millennials
Attributes	• Command and control • Self-sacrifice	• Optimistic • Workaholic	• Independent • Skeptical	• Hopeful • Determined
Likes	• Respect for authority • Family • Community involvement	• Responsibility • Work ethic • Can-do attitude	• Freedom • Multitasking • Work-life balance	• Public activism • Latest technology • Parents
Dislikes	• Waste • Technology	• Laziness • Turning 50	• Red tape • Hype	• Anything slow • Negativity

Other attributes show generational trends as well (for example, attitude toward changing jobs or locus of community). One of the most striking attributes is the attitude toward the Internet. For the Net Gen, the Internet is like oxygen; they can't imagine being able to live without it.

Maybe It's Not an "Age Thing"

Although these trends are described in generational terms, age may be less important than exposure to technology. For example, individuals who are heavy users of IT tend to have characteristics similar to the Net Gen. In fact, the pervasiveness of technology -- in our professions and in our personal lives -- virtually ensures that most individuals gradually assume some Net Gen characteristics. For example, ask yourself:

- Are you more comfortable composing documents online than longhand?
- Have you turned your "remembering" (phone numbers, meetings, and so on) over to a technology device?
- Do you go to meetings with your laptop or PDA?
- Are you constantly connected? Is the Internet always on whether you are at home or work? Is your cell phone always with you?
- How many different activities can you effectively engage in at one time?

- Do you play video or computer games?[24]

The differentiating factor may not be so much one person's generation versus another; the difference may be in experience. Whether the Net Generation is a purely generational phenomenon or whether it is associated with technology use, there are a number of implications for colleges and universities. Most stem from the dichotomy between a Net Gen mindset and that of most faculty, staff, and administrators.

Is More Technology Necessarily Better?

Maybe yes, maybe no. It is an almost instinctive assumption to believe that Net Gen students will want to use IT heavily in their education; they certainly do in their personal lives. However, if you ask Net Gen learners what technology they use, you will often get a blank stare. They don't think in terms of technology; they think in terms of the activity technology enables. In general, the Net Gen views the Internet as an access tool -- a medium for distribution of resources rather than a resource with limitations.[25]

Student satisfaction with online learning exemplifies our assumptions about online learning. Since Net Geners spend so much of their time online, it seems reasonable to expect that they would have a strong preference for Web-based courses. The reverse is actually true. Older students (Matures and Baby Boomers) are much more likely to be satisfied with fully Web-based courses than are traditional-age students. The reason relates to the Net Gen desire to be connected with people and to be social as well as their expectations of higher education. Traditional-age students often say they came to college to work with faculty and other students, not to interact with them online. Older learners tend to be less interested in the social aspects of learning; convenience and flexibility are much more important.

The implication is that colleges and universities should not assume that more technology is necessarily better. Technology that enables certain types of activities is likely to be appreciated. For example, wireless networking enables learner mobility and makes it possible to be constantly connected. The majority of wireless network use, however, may be outside the academic realm. Using technology to increase customization, convenience, and collaboration is well received; however, its integration into most courses or curricula is not as deep as into students' personal lives.

How Well Do We Know Our Students?

It is easy to assume that we understand our students, but there is often a difference in perspective between the Net Generation and faculty/administrators. As a result, it is important that schools, colleges and universities ask the right questions and not simply assume that the current student cohort is like we were. Important questions for colleges and universities to ask include the following.

- **Who are our learners?** Although the institution may have demographic information (date of birth, home town, gender, ethnicity, and so on), we may not understand how students view the world, what is important to them, or even how they learn best. It is increasingly important that colleges and universities engage learners in a dialogue to better understand their perspective. Institutions make massive investments (IT infrastructure, residence halls, recreational facilities) for

the sake of meeting students' wants and needs; basing these decisions on assumptions is risky.

- **How are today's learners different from (or the same as) faculty/administrators?** Although the Net Generation may be different in many ways from Baby Boomers, some things stay the same. Students still come to college to meet people, to socialize, and to interact with faculty. Many of the measures of student engagement have consistently shown the importance of interaction with faculty and other students, as well as a supportive campus environment. Student preferences for how they receive information are likely different, however -- they favor more graphics, a rapid pace, and immediate responses. If faculty and administrators can understand the factors that lead to student success -- which persist and which differ from their own college experience -- they will be able to more effectively develop programs and target investments.
- **What learning activities are most engaging for learners?** It isn't technology per se that makes learning engaging for the Net Gen; it is the learning activity. If today's students are experiential learners, lectures may not be an optimal learning environment. If they are community oriented, providing opportunities for peer-to-peer experiences or team projects may be preferable to individual activity. There are significant individual differences among learners, so no one-size-fits-all approach will be effective. Even so, learning science and the habits of the Net Generation provide some clues as to how we can improve learning.
- **Are there ways to use IT to make learning more successful?** Learning science indicates that successful learning is often active, social, and learner-centered. However, with the multiple responsibilities of faculty, staff, and administrators, as well as the large numbers of students most campuses serve, ensuring successful learning without the support of IT may be impossible. Individualization and customization are laudable goals for instruction; they are also time intensive. With the appropriate use of technology, learning can be made more active, social, and learner centered—but the uses of IT are driven by pedagogy, not technology.

Concluding Remarks

Educating students is the primary goal of colleges and universities. However, reaching that goal depends on understanding those learners. Only by understanding the Net Generation can colleges and universities create learning environments that optimize their strengths and minimize their weaknesses. Technology has changed the Net Generation, just as it is now changing higher education.[26]

---

[1] "What is Distance Learning?" California Distance Learning Project, http://www.cdlponline.org/index.cfm?fuseaction=whatis, retrieved: July 24, 2005

[2] The American Center for the Study of Distance Education, Michael Moore director, Penn State, http://www.outreach.psu.edu/de/what_is_de.html, retrieved: July 24, 2005

[3] ITC's Definition of Distance Education, http://144.162.197.250/definition.htm, retrieved: July 24, 2005

[4] The USDLA definition, http://www.usdla.org/, retrieved: July 24, 2005

[5] Distance Education: A Consumer's Guide...What distance learners need to know, published by Western Cooperative for Educational Telecommunications, http://www.wcet.info/resources/publications/conguide/conguida.htm, retrieved: July 24, 2005

[6] Distance Learning Defined, Oxford College, http://www.oxforddistancelearning.com/article02.asp, retrieved: July 24, 2005

[7] "Distance Education: Can We Debunk Some of the Myths?" Robert Aucoin, Distance Education Coordinator, University of Alberta, www.humanities.ualberta.ca/TLC/projectspres/DEARTS.ppt, retrieved: July 24, 2005

[8] Southwestern Oregon Community College FAQ, http://www.socc.edu/dist_learn/faqs.html, retrieved: April 6, 2005

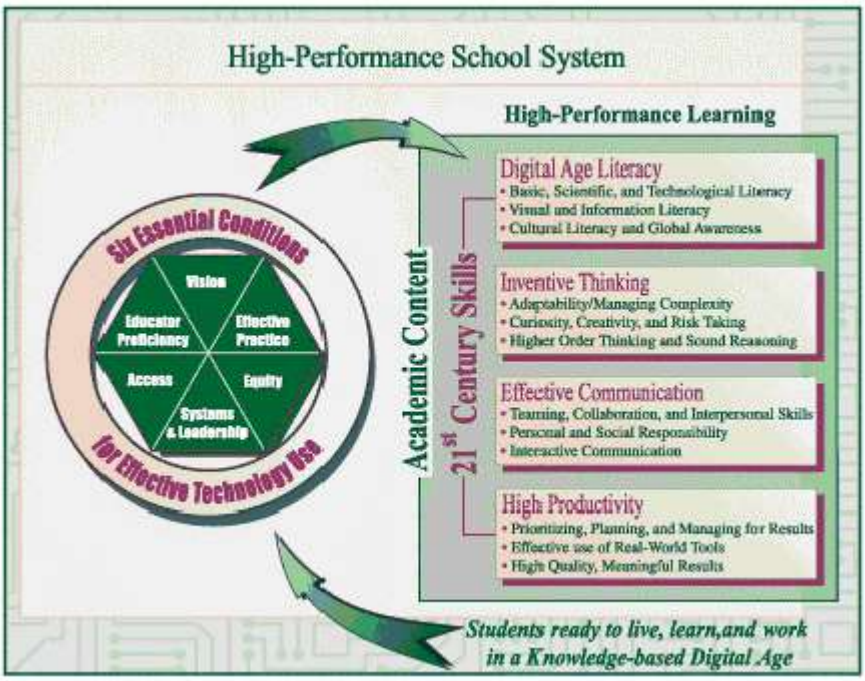
[9] "Theory and Practice of Online Learning," Editors: Terry Anderson & Fathi Elloumi, Managing editor: Gilda Sanders, Athabasca University, 2004, http://cde.athabascau.ca/online_book/, retrieved: April 20, 2004

[10] "Revolutionizing Learning in the Digital Age," Mitchel Resnick, November 15, 2003, http://www.educause.edu/ir/library/pdf/ffpiu014.pdf, retrieved: July 7, 2005

[11] "The Sustainability Challenge: Taking EdTech to the Next Level," Edited by Norris Dickard, Benton Foundation, Education Development Center, Inc., Center for Children and Technology, March 2003, http://www.benton.org/publibrary/sustainability/sus_challenge.html, retrieved: March 6, 2003

[12] ibid, "Revolutionizing Learning in the Digital Age"

[13] "A Framework for Effective Technology Use," *enGauge*®, http://www.ncrel.org/engauge/, retrieved: July 24, 2005. Note: This following graphic shows the components and relationships of a High-performance School system.



[14] ibid, "A Framework for Effective Technology Use" Note: Each skill cluster is further broken down into representative skill sets, which offer guidance on recognizing student performance in developing the *enGauge* 21st Century Skills.

Digital-Age Literacy *includes the following:*
Basic Literacy: Language proficiency (in English) and numeracy at levels necessary to function on the job and in society to achieve one's goals and to develop one's knowledge and potential in this Digital Age.

Scientific Literacy: Knowledge and understanding of the scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.
Economic Literacy: The ability to identify economic problems, alternatives, costs, and benefits; analyze the incentives at work in economic situations; examine the consequences of changes in economic conditions and public policies; collect and organize economic evidence; and weigh costs against benefits.
Technological Literacy: Knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals.
Visual Literacy: The ability to interpret, use, appreciate, and create images and video using both conventional and 21st century media in ways that advance thinking, decision making, communication, and learning.
Information Literacy: The ability to evaluate information across a range of media; recognize when information is needed; locate, synthesize, and use information effectively; and accomplish these functions using technology, communication networks, and electronic resources.
Multicultural Literacy: The ability to understand and appreciate the similarities and differences in the customs, values, and beliefs of one's own culture and the cultures of others.
Global Awareness: The recognition and understanding of interrelationships among international organizations, nation-states, public and private economic entities, sociocultural groups, and individuals across the globe.

Inventive Thinking *is comprised of the following "life skills":*
Adaptability and Managing Complexity: The ability to modify one's thinking, attitude, or behavior to be better suited to current or future environments; and the ability to handle multiple goals, tasks, and inputs, while understanding and adhering to constraints of time, resources, and systems (e.g., organizational, technological).
Self-Direction: The ability to set goals related to learning, plan for the achievement of those goals, independently manage time and effort, and independently assess the quality of learning and any products that result from the learning experience.
Curiosity: The desire to know or the spark of interest that leads to inquiry.
Creativity: The act of bringing something into existence that is genuinely new and original, whether personally (original only to the individual) or culturally (where the work adds significantly to a domain of culture as recognized by experts).
Risk Taking: The willingness to make mistakes, advocate unconventional or unpopular positions, or tackle extremely challenging problems without obvious solutions, such that one's personal growth, integrity, or accomplishments are enhanced.
Higher-Order Thinking and Sound Reasoning: The cognitive processes of analysis, comparison, inference and interpretation, evaluation, and synthesis applied to a range of academic domains and problem-solving contexts.

Effective Communication *involves:*
Teaming and Collaboration: Cooperative interaction between two or more individuals working together to solve problems, create novel products, or learn and master content.
Interpersonal Skills: The ability to read and manage the emotions, motivations, and behaviors of oneself and others during social interactions or in a social-interactive context.
Personal Responsibility: Depth and currency of knowledge about legal and ethical issues related to technology, combined with one's ability to apply this knowledge to achieve balance, integrity, and quality of life as a citizen, a family and community member, a learner, and a worker.
Social and Civic Responsibility: The ability to manage technology and govern its use in a way that promotes public good and protects society, the environment, and democratic ideals.
Interactive Communication: The generation of meaning through exchanges using a range of contemporary tools, transmissions, and processes.

High productivity *currently is not a high-stakes focus of schools, yet the skills involved in this cluster often determine whether a person succeeds or fails in the workforce:*
Prioritizing, Planning, and Managing for Results: The ability to organize to efficiently achieve the goals of a specific project or problem.
Effective Use of Real-World Tools: The ability to use real-world tools—the hardware, software, networking, and peripheral devices used by information technology (IT) workers to accomplish 21st century work—to communicate, collaborate, solve problems, and accomplish tasks.
Ability to Produce Relevant, High-Quality Products: The ability to produce intellectual, informational, or material products that serve authentic purposes and occur as a result of students using real-world tools to

solve or communicate about real-world problems. These products include persuasive communications in any media (print, video, the Web, verbal presentation), synthesis of resources into more useable forms (databases, graphics, simulations), or refinement of questions that build upon what is known to advance one's own and others' understanding.

[15] "The Key to Competitiveness: A Guide for College and University Leaders," Washington, D.C.: American Association of State Colleges and Universities, page 1, http://www.aascu.org/book/default.htm, retrieved July 10, 2005

[16] "Educating the Net Generation," Diana G. Oblinger and James L. Oblinger, Editors, http://www.educause.edu/ir/library/pdf/pub7101.pdf, retrieved July 9, 2005

[17] "The Internet Goes to College: How Students Are Living in the Future with Today's Technology," Steve Jones, Washington, D.C.: Pew Internet & American Life Project, http://www.pewinternet.org/reports/toc.asp?Report=71, September 15, 2002,

[18] ibid, "Educating the Net Generation"

[19] ibid, "Educating the Net Generation"

[20] ibid, "Educating the Net Generation"

[21] ibid, "Educating the Net Generation"

[22] ibid, "Educating the Net Generation"

[23] ibid, "Educating the Net Generation"

[24] ibid, "Educating the Net Generation"

[25] ibid, "Educating the Net Generation"

[26] ibid, "Educating the Net Generation"