Preparing Students for Their Technological Future

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Rigor, Relevance, and Relationships for ALL Students

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If the American education system is to prepare its students to meet the demands of an increasingly technological world, indeed if it is to be effective at all, it must integrate technology into the academic curriculum. The prospect of personal technology in school, however, makes some teachers and administrators uncertain about how to proceed. After all, what will students be doing with their cell phones and personal digital assistants (PDAs)? Will they be looking up facts on the Internet, seeking answers from friends, or perhaps sending a copy of a test to a friend?

This ambivalence about technology stems in part from our own experience with it. The very electronic devices that have become an extension of our children are an enigma to many of us in the older generation. The buttons — in fact, the entire keyboard — on these devices are often too small for us to see and use. We can't read the screen. Technology alienates us from one another, or we become dependent on it. In short, we tend to see technology as a problem rather than a solution — for us as educators and for students in the classroom. In this scenario, we are unwittingly failing to prepare our students for a technology-driven world that is nothing like the place that many of us graduated into. Yet, the reality is that students of the 21st century need a technology-based education to survive in a technological world.

This imperative is echoed in the first draft of the National Educational Technology Plan (NETP), released in April 2010 by the U.S. Department of Education. The plan, which describes how information and communication technologies can help transform American education into a model of 21st century learning, outlines goals in five key areas: learning, assessment, teaching, infrastructure, and productivity. "Just as technology is at the core of virtually every aspect of our daily lives and work, we must leverage it to provide engaging and powerful learning experiences," the report states. In conjunction with the plan, the education department has called for higher standards, particularly in reading and math, and better use of data to make sure students are meeting more rigorous standards.

The fact is that, while our school system is getting better at educating all students, many young people lack the skills and knowledge they need to be successful. This is not because schools have failed, but because society demands a higher level and different set of skills than schools were ever designed to teach. Educators have realized this and have spent billions of dollars nationwide to bring computers into the classroom to help remedy the problem. But instead of using technology to create a new model for change, schools have incorporated computers into the existing structure. Rather than having students use computers, say, to better understand a math equation through a virtual hands-on activity, teachers may limit the use of that tool to word processing, much as we used the typewriter a generation ago.

Pervasive Technology

As many schools wallow in the past, technology is becoming ever more pervasive. It is getting smaller, speedier, stronger, and more adaptable. Technologies developed in the fields of nanotechnology, biotechnology, imaging, and information technology are advancing at

unprecedented rates, impacting manufacturing, electronics, transportation, military defense, communication, healthcare, the food industry, and the list goes on.

Nanotechnology, what some researchers have dubbed the "shrinking technology," has exploded in recent years. In this field, researchers work with particles at the atomic level to build devices and make new materials. One nanometer is a billionth of a meter. Consider that hundreds of thousands of particles the size of a nanometer could fit inside the period at the end of this sentence. A snowflake measures three million nanometers in diameter.

The chemical composition of nanophase materials is the same as their conventional counterparts, but the particles, or crystals, that serve as basic building blocks of the material are much smaller. The smaller-size building blocks alter a material's mechanical, optical, electrical, and magnetic properties and create, for instance, copper that is five times harder than its conventional form and ceramics that bend instead of breaking.

For example, ApNano, an Israeli company, has developed a nanomaterial for body armor that is five times as strong as steel and half the weight of current military protective gear. Rice University scientists are using carbon nanotubes, cylinders of carbon each 1-25 nanometers in diameter, to develop "smart" materials that will allow airplanes to repair themselves in midflight. Or, consider the "power shirt," which researchers at Georgia Institute of Technology are working on, that can generate electricity through the wearer's body motion. The generated energy is enough to power small electronic devices for soldiers, hikers, and others. The fibers could also be woven into curtains, tents, or other items to capture energy from wind motion or sound vibration.

Building small is not just for clothing and gear. Researchers in Denmark recently used DNA to construct a nanosize lockbox along with a set of DNA keys. The 42-by-36-by-36 nanometer container can fit inside a blood cell and could be adapted for a wide range of applications, from drug-delivery devices to components for electronics.

As far as the electronics industry itself, today's cell phones and BlackBerry devices are huge in size compared to the technology that likely will be here soon. How about a watch, earring, or bracelet that contains a computer? In the end, the only way to keep this technology out of the classroom will be to ban all jewelry. And when it's placed in buttons, will we ban clothing?

The truth is that students are bringing their electronic technology into school whether educators like it or not. Among 12- to 18-year-olds, 94% have a cell phone or PDA. Furthermore, according to a *USA Today* survey, students admit to using cell phones to store information for a test, send answers or a picture of a test to friends, or search the web. Should we not teach students to use technology in a manner that benefits them — and us — academically?

Imparters of Wisdom in a Technologically Driven World

The challenge for educators is not to dismiss or keep up with students' latest technological know-how, but to create meaningful learning experiences in which students are taught how to *apply* their knowledge to solve real-world problems. In reaching out to students who are so intertwined with the latest technology, we need to ask ourselves, "How can we use the Internet or the computer to enhance instruction and engage students?" Science teachers might consider, for example, how to use Microsoft's WorldWide Telescope, a website that enables a computer to function as a virtual telescope by incorporating worldwide imagery from ground and space-based telescopes for a seamless exploration of the universe.

Technology allows students to work with graphic and interactive displays, viewing study material as it appears in real life. It provides them with tools to obtain immediate results. Distance learning can be an everyday occurrence, with students communicating with each other in the same or separate classrooms or across the country and the world. Organizational and problem-solving skills can be developed through the use of technology and honed for use in the work world.

In high-performing schools, technology is used on a regular basis. Teachers access Internet resources, incorporate online tutorials for students who need extra help, and connect graphic calculators to TV monitors. For these teachers, technology doesn't sit idle in the classroom; rather, it enhances instruction as a tool, just as a pencil or chalkboard did in past generations. Elementary teachers, for example, might use short (under five minutes) video clips to provide students with visuals to help clarify concepts and bring relevancy to a lesson. Middle grade and high school teachers can turn to the Internet to teach students how to raise social consciousness for a particular cause and learn about personal responsibility by starting a blog.

Video games, typically seen as distractions to academic study, also are gaining traction among schools for enhancing instruction. Introducing such games into the classroom allows students to connect to a medium they are familiar and comfortable with. Appropriately designed video games can be used as a way to start a unit of study or to reinforce previously learned concepts. Such video games also offer the potential for new interdisciplinary collaboration between the arts and core-content subject areas, such as math, science, English language arts, and social sciences.

Finding appropriate video games that are educational is increasingly easy. Companies such as Scholastic and PBS Kids have devoted websites to kid-friendly games, activities, and accompanying teacher resources. There are also video games that focus on research and development projects. For instance, the Education Arcade website offers games such as Supercharged!, which places students in a three-dimensional environment in which they must navigate a spaceship by controlling the electric charge of the ship. DreamHaus uses architecture as an entry point for learning AP-level mathematics, engineering, and physics. Video games in the classroom is an ambitious, interactive approach to education. They provide a way to incorporate 21st century skills and allow students to be active participants in the learning process.

The 21st Century Teacher

Teachers more than ever have a vital role to play in helping students realize their futures by providing them with instruction that gives direction and allows them to hone their new cognitive and technological skills. In a nutshell, students need facilitated content to be fully capable citizens, whether its blogging on a social network site or solving a math problem. They may have limitless technology and information at their disposal, but can they access that information efficiently and effectively? Can they evaluate it critically and competently and identify objective facts from propaganda? Do they understand the real ethical, legal, and moral issues concerning access to and use of information? Can they create meaning from data? In essence, do they know the value of information, aside from what is needed to pass a test?

When teachers start asking these questions, they begin to look at education in the larger context of today's society. That context includes helping students solve real-world current problems and prepare for a future of unknowns. For instance, the food industry is increasingly

using nanotechnology to boost nutrition, increase shelf life, and improve taste and texture. A nutritional drink for children, for example, contains nano-iron particles, and "nanocapsules" are used in some cooking oils. Nanoparticles have been incorporated into sunscreens and even in fertilizers. Yet, there has been little research or oversight to determine any potential risks of such nanoparticles.

Moreover, no one has to look farther than the 2010 Toyota recall crisis to ponder the complexity of technology that led to the "stuck-pedal" debacle. One can't help but wonder about the pitfalls of programming the inner workings of a vehicle on a computer chip. The point is that changes in science and technology are occurring much more rapidly than ever before. While these innovations bring many benefits, they add to the challenges of our world and increase the skill level every person needs to function effectively in it.

Globalization

The society in which our students must succeed has become a global one, in large part due to technology. Through computer and Internet access, millions of students in developing countries around the world have the opportunity to acquire the necessary skill set to compete worldwide for good jobs. For them, technology has essentially leveled the global playing field.

Kantathi Suphamongkhon, distinguished professor at the University of California at Los Angeles and former Thailand foreign affairs minister, said it well when he pointed out: "Modern globalization is a major part of the electronic revolution that has made global communications cheap and acceptable to anyone who has the skills and the strategy to use it."

In his book, *A Whole New Mind: Moving from the Information Age to the Conceptual Age*, Daniel Pink makes the case that three major trends – abundance, the economic influence of Asia, and the ability to automate many jobs – will drive the need for a new kind of worker. He calls them "knowledge workers," people who get paid for putting to work what they learn in school rather than for their physical strength or manual skill. Pink asks his readers to answer three questions about their employment and the future employment of students:

- Can someone overseas do it cheaper?
- Can a computer do it faster?
- Am I offering something that satisfies the nonmaterial, transcendent desires of an abundant age?

The business world knows it can outsource labor and gain massive hiring advantages by paying less overhead for a large and skilled workforce, while being closer to future clients. In India, a company can hire eight engineers at the same pay one American. Business leaders know, too, that a person's major in college matters far more than where he or she went to college. Note that there are more sports management majors in the U.S. than engineering majors. If this doesn't scare us, the words of former

Intel spokesman Howard High should. He commented in 2008: "We go where the smart people are. Now our business operations are two-thirds in the United States and one-third overseas. But that ratio will flip in the next 10 years."

Cheap labor is only one reason American and European executives look overseas to meet their information technology (IT) needs. American executives have trouble finding local candidates with the necessary skills. A decrease in U.S. college graduates with degrees in engineering and

computer science means that there are fewer Americans qualified to do the job. Meanwhile, as global demand increases, offshore IT hubs such as India, China, Russia, and other Eastern European countries are graduating thousands of highly skilled computer engineers and programmers each year.

The United States is competing in a global economy like never before in our history, and we are losing ground fast. Over the last 30 years, China has embraced capitalism to lift millions of people out of poverty. Families who once drove ox carts and lived in bamboo huts now have cars and comfortable homes. The middle class continues to grow. China defied the global recession of 2008-09 and remained the fastest growing major economy. Moreover, resource-rich developing and newly industrialized countries, such as Brazil and South Africa, have greatly benefited from China's demand for commodities, such as iron ore and copper.

When it comes to exporting IT services, India remains a powerhouse, with more than $47 billion in exports during 2008-09. Other regions in the world, particularly Eastern Europe, are catching up as well by taking advantage of technology, innovation, and globalization. Russia, for example, is expected to see an increase in its IT market from $18.2 billion in 2008 to nearly $45 billion in 2013.

If the United States is to retain its dominance in the global economy, it needs to have the most highly productive workforce in the world. That will require schools to provide a much more rigorous and relevant education than many students presently receive. The question is, how will we accomplish this during times of tight resources?

Disruptive Innovation

Our lingering financial problems, coupled with globalization and the increasing demand for school accountability from the public, could be the breaking point for many schools. Despite stimulus money, districts are still in dire straits, laying off thousands of teachers, shuffling others into unfamiliar grade levels, and even closing schools altogether. The K-12 schools that survive this tumultuous period will likely look quite different in the near future.

One phenomenon that will contribute significantly to this transformation of schools, if educators are willing to embrace it, is "disruptive innovation," a term coined by Clayton Christensen. In his 2008 book, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*, Christensen describes disruptive innovation as "the process by which an innovation transforms a market whose services or products are complicated and expensive into one where simplicity, convenience, accessibility, and affordability characterize the industry." In this process, a product or service first takes root in simple applications at the bottom of a market, geared toward people considered "nonconsumers." It then moves up the market ladder, eventually displacing established competitors.

For example, Apple originally sold one of its early computer models as a toy for children. Kids didn't care that the product was not anywhere near as good as the premier computers at the time. Parents bought it for their children because it was better than nothing at all, since the alternative was a $200,000 high-end "minicomputer" built by Digital Equipment Corporation (DEC), the leading minicomputer company in the 1970-80s. The Linux OS operating system is another example of disruptive innovation. The operating system was originally inferior in performance to other server operating systems, but inexpensive compared to them. So people, originally considered nonconsumers, bought it. After years of improvements, Linux is now installed in more than 85% of the world's 500 fastest supercomputers.

The technology industry isn't the only business field that has used disruptive innovation to its advantage. Take the insurance industry, for instance, which changed its business model to capitalize on medical tourism. Although medical tourism was once reserved for people seeking elective surgery who could afford a weeklong trip overseas, insurance companies recently expanded this option to not-so-well-off Americans, originally considered a nonconsumer group. Why? Because some people were starting to turn to foreign countries for better deals, and not necessarily better quality, on procedures ranging from hip replacement to cancer treatment.

So, insurance companies jumped on the bandwagon in the effort to cut down on skyrocketing medical costs in the United States. Blue Cross Blue Shield of South Carolina now has a subsidiary company, Companion Global Healthcare, which offers medical tourism services to individuals and businesses. Hannaford supermarkets, based in Maine, recently added an international option for hip replacements to its healthcare plan. The medical tourism industry is expected to expand from an estimated $60 billion in 2006 to $100 billion by 2012.

Applying Disruptive Innovation to Schools

At first glance, there are no obvious areas of nonconsumption in our education system. All children are required to attend school. Yet, there are as many pockets of "nonconsumption" as there are student learning needs. For example, there is often little recourse for students who cannot keep up with a unit of instruction. If they don't understand the material that's a prerequisite for an upcoming lesson, they must move ahead anyway and struggle on their own or fail the class altogether. Many of these students become disengaged and drop out of school. Likewise, there are students who would thrive in Advanced Placement courses that are not offered in their schools for one reason or another. Fortunately, teachers are starting to incorporate computer-based or online learning to fill this learning void as an alternative to doing nothing.

Online learning has increased from 45,000 enrollments in 2000 to roughly 1 million in 2007, and shows signs of continuing to grow at an even more rapid pace. Disruptive innovation is at work in other pockets of education as well. Teachers who can't obtain funding for science and other field trips have turned to virtual field trips, such as virtual tours of the Smithsonian and other museums all over the world.

Schools across the country also are beginning to take advantage of "virtual desktops" as a low-cost way to bring computing into the classroom. Desktop virtualization technology allows multiple users to compute at the same time through a shared computer. An individual typical uses only about 5% of the capacity of his or her computer. The idea of desktop virtualization is to share the excess power with other users and save on energy and technology costs. Using a few simple hardware devices and a software program, technicians can hook up from 7-16 virtual desktops to a single access point, which allows users to work on different programs and applications at the same time. Each virtual desktop, which costs between $70-100 per user, includes a monitor, keyboard, and USB mouse. So far, the biggest market has been overseas, to countries such as Brazil and South Africa, where millions of students are benefitting from the inexpensive technology.

Shifting from Teacher-Centered to Student-Centered Instruction

For disruptive innovation to begin to make a significant foothold for real transformation, our schools must focus on student-centered learning instead of teacher-centered instruction. When

teachers view their role as facilitators of learning and focus more on the students, they can begin to customize instruction based on each student's need, using software as an important delivery vehicle. They will be able to handle larger classes while paying attention to students' different learning needs. Students will use computers to access online programs that allow them to learn at their own pace.

As learning becomes more personalized, teachers will have the primary responsibility of orchestrating the mastery of 21st century skills that students need to be successful, such as leadership, team building, and various types of literacy skills. Teachers also will help students apply these critical skills through internships, authentic speaking opportunities, portfolio development, etc.

Computers and online courses won't replace core academic teachers, but they will likely take the place of specialized teachers in a physical classroom. An online Chinese language course, for example, can be taught to students across the country, eliminating the need for common time and space. Much of the content will be computerized, but a real teacher will still be somewhere, delivering knowledge and assessing student performance.

Virtual schools have been established across the country, such as Florida Virtual School, ACCESS in Alabama, and Kentucky Virtual Schools, and many more are being developed by state departments of education. Penn Foster Career School, a nationally accredited online school, offers a full four-year high school curriculum and an extensive selection of college-level career training courses. More than 300 U.S. high schools and nearly one-third of the nation's Job Corps use the Penn Foster curriculum. More than 46,000 students are enrolled in a Penn Foster High School course, and each year more than 7,000 students graduate from Penn Foster High School.

With this shift from teaching in a way that focuses on facts to pass a test to a more comprehensive student-centered approach that uses the Internet and other resources just described, educators will be in a better position to prepare students for lifelong learning in a technological world. In short, schools need to focus on preparing students for college *and* a demanding workforce, rather than trying to do a better job of teaching what they have always been teaching.

College and Career Ready

Recently, the discussion about the purpose of K-12 education has shifted from preparing students for college to preparing them to become "college-and-career ready." Preparation for college historically has been considered the pinnacle of the K-12 education system's goal of preparing students to be productive citizens.

However, today's workplace – pushed by technology and global competition – requires skills and knowledge that are often higher than and fundamentally different from those required for higher education. In the past, a student could leave high school unprepared for college and find success in the workplace. Today, that is seldom the case. Furthermore, many students who do go on to earn college degrees are finding that they do not qualify for jobs for which they attended college.

In reality, too few students are prepared for college or a career, and even fewer are prepared for both. Students need the appropriate skills and knowledge for higher education. They also need to know how to apply relevant skills and knowledge in an increasingly sophisticated workforce.

College Ready

Although there has been a focus on preparing students for higher education, the truth is that the knowledge and skills currently taught in most high schools are different from college entrance and placement requirements.

According to ACT's latest report, *ACT Profile Report - 2009*, there has been no significant increase in the percentage of U.S. high school graduates who met ACT's college-readiness benchmarks in math, science, reading, and English over the last several years. Students who meet these benchmarks are ready to earn a C or higher in first-year college courses in all four subjects. Colleges use the ACT placement exam as one of several measures in making admission decisions.

Schools must do more to ensure that college-bound high school graduates have the skills necessary to meet higher education expectations, the report warned. Among the findings:

- Only 28% of ACT-tested 2009 students are ready for college-level biology.
- Of the students tested, 42% are ready for college-level algebra.
- Nearly 40% of students could not solve multistep problems involving fractions and percentages.
- Of the students, 40% could not predict the results of an additional trial of a scientific experiment.
- In English, 40% were not able to use the correct adverb or adjective in a sentence, use the correct preposition in a phrase, or make sure that the subject and verb agreed in a sentence.
- In reading, 30% were unable to evaluate the contribution that significant details make to the text as a whole.

In the report, *Redefining College Readiness*, David Conley helps to create an operational definition of college readiness and outlines the essential skills that students need for college success. Conley is Founder and CEO of the Educational Policy Improvement Center (EPIC). The report, commissioned by the Bill & Melinda Gates Foundation, consists of four facets of college readiness.

- ***Habits of the Mind*** used across all content areas involves intellectual openness, inquisitiveness, research, analysis, reasoning, providing proof in interpretation, precision and accuracy, and complex problem-solving skills.

- ***Key content*** means areas in which Habits of the Mind can be used and demonstrated. Key content includes writing, math, science, social studies, world languages, and the arts.

- ***Academic behavior*** consists largely of having good study skills and the ability to self-monitor.

- ***Contextual skills and awareness*** involves knowing how a college operates (including the admission, financial aid process, and overall college requirements) and being familiar with the norms, values, and conventions of interactions in a college setting.

Following are some examples of what students have to be able to do in a typical college course.

- Write a 3-5-page research paper that is structured around a cogent, coherent line of reasoning. Such a paper must include several appropriate sources, be relatively free from spelling and grammatical errors, and be easily understood by the reader.

- Read a range of nonfiction publications and technical materials, using appropriate decoding and comprehension strategies to identify key points and note areas of question or confusion.

- Employ fundamentals of algebra to solve multistep problems, including problems without a single obvious solution and problems requiring mathematics beyond algebra.

- Conduct basic scientific experiments or analyses that require, among other skills, accurate interpretation of data or observations in relation to an initial hypothesis; a plausible explanation of unanticipated results; and presentation of findings to an appropriate audience, using the language of science that includes models, systems, and theories.

- Conduct research on a topic and be able to identify key-source materials that could be accessed to shed light on the question being researched; organize and summarize the results from the search; and synthesize the findings in a manner that makes the most sense based on the nature of the question being investigated.

- Interpret two conflicting written explanations of the same event or phenomenon, taking into account each author's perspective, the cultural context of each source, the quality of the argument, its underlying value positions, and any potential conflict of interest an author might have in adopting a particular point of view.

- Communicate in a second language, using that language in a culturally appropriate fashion for common daily tasks and interactions, without resorting to literal translation except in specific isolated cases.

- Participate in a study group outside of class with students who represent a continuum of academic abilities and cultural backgrounds to complete an assignment or project or to prepare for an exam.

- Complete a problem or assignment that requires approximately two weeks of independent work and extensive research, seeking periodic feedback from teachers and other pertinent resources along the way and using the feedback to revise and strengthen the final product.

- Create and maintain a personal schedule that includes a to-do list with prioritized tasks and appointments.

- Utilize key technological tools, including appropriate computer software, to perform academic tasks such as conducting research, analyzing data sets, writing papers, preparing presentations, and recording data.

- Locate websites that contain information on colleges, the admissions process, and financial aid. Navigate them successfully, comparing the programs and entrance requirements of several colleges and assessing the cost and overall feasibility of attending each institution.

- Present an accurate self-assessment of readiness for college by analyzing and citing evidence from classroom work and assignments, grades, courses completed, and national and state exams taken.

Career Ready

When it comes to preparing students for today's technological workplace, our K-12 schools are doing an even worse job. While they are geared toward preparing students for college success (however inadequately at times), they are missing a key ingredient that ties education to careers and lifelong success. This ingredient is the *application* of the skills and knowledge needed to be successful not just in college, but also in chosen careers as well. Educators, parents, and the public at large must recognize that, while we must continue to prepare our young people to be good citizens and ready them for higher education, we must also acknowledge a fundamental purpose to education — learning to *apply academic skills needed for the increasingly sophisticated workplace and society.*

There are a number of studies that indicate employers are not satisfied with the degree to which students are being prepared for their chosen careers. The Conference Board is an international not-for-profit organization that disseminates information about management and the marketplace. In spring 2006, the Board surveyed human-resource professionals on whether the skills high school graduates exhibited were adequate for success in today's workplace. The results were overwhelmingly negative: those surveyed felt they were not receiving the education that will make them successful outside of school. This also was shown to be the case with graduates of two- and four-year colleges.

Schools must work to develop students who are prepared to meet the needs of our economy. According to the Conference Board: "The education and business communities must agree that applied skills integrated with core academic subjects are the 'design specs' for creating an educational system that will prepare our high school and college graduates to succeed in the modern workplace and community life. These skills are in demand for all students, regardless of their future plans, and will have an enormous impact on their ability to compete."

Cisco Systems has captured the trend of education and communicated the paradigm shift that must occur in order for education to address the needs of the 21st century learner. This shift is described as moving from Education 1.0 to Education 3.0. Education 1.0 refers to the traditional education system. Education 2.0 is the next phase, in which the focus is on curriculum, teachers, accountability and leadership. Education 3.0 is more complex. It is based on achieving holistic information, 21st century pedagogy and skills, all of which are enabled through technology and supported through an adapted reform agenda. The reality is that no education leaders have yet accomplished the goals set in Education 3.0.

One area that educators will need to focus on in order to make this shift to Education 3.0 is reading. Studies by the International Center and other organizations have shown that employability and career success in an increasingly competitive global economy depends on reading to a far greater extent than in the past.

In a 2006 study, the International Center found that reading requirements for entry-level jobs were much higher than was ever expected. This analysis was performed using MetaMetrics' Lexile Framework® for Reading, which measures the readability of text passages on an evenly incremented scale from 0 to 2000L. The study examined a wide array of materials, including handbooks, manuals, government forms, and standard business documents.

The analysis revealed, among other findings, that a large number of entry-level jobs have higher reading requirements than most high school texts and tests. Moreover, the reading requirements in entry-level jobs are higher than is required for many intermediate- and advanced-level jobs. This is largely because of the technical nature of the manuals used in entry-level jobs. Perhaps even more surprising, entry-level job reading requirements exceed the reading requirements of all but the most technical college coursework. A few of the findings follow.

Students in grades 11-12 typically read at Lexile levels of 940-1220L. Among the Lexile levels for entry-level jobs:

- Finance — 1385L
- Public safety —1285L
- Information technology —1280L
- Hospitality and tourism — 1225L

The reading requirements to be an active and informed citizen also are high. Consider the Lexile levels to be able to read and comprehend the following:

- Standard health insurance form — 1360L
- Newspapers — 1330L
- Student loan application — 1270L
- Federal tax form W-4 — 1260L

Reading —which includes the ability to find, analyze, and synthesize written information — is the gateway to lifelong learning and success in a rapidly changing world. People who cannot read with confidence and efficiency are socioeconomically at risk in most adult roles as consumers, citizens, and parents and especially as wage-earners in an increasingly literate global economy. The ability to process documents and text in all forms creates resiliency for the trainings and multiple retrainings that today's students will encounter in the workforce during their careers.

Conclusion

Considering all the research conducted in the area of education in a technologically driven world, one thing seems clear: *What* needs to be learned is secondary to *how to use* the vast amount of information that is so readily available. Problem solving, information processing, working collaboratively, and *knowing what to do when you are not sure what to do* are essential skills necessary to succeed in college and career, as well as to manage the dynamic setting of the 21st century.

We must remember that schools were not initially designed to educate every child to high academic standards. Historically, high schools, in particular, sorted students into two tracks — those deemed capable of postsecondary education and those who were not. Today, the expectation is for every student to graduate from high school and be prepared for higher education and the workforce. Moreover, students today use technology constantly. These digital natives do not respond well to the textbook-driven lesson plans of previous eras.

The traditional role of teachers has been as dispensers of knowledge. In today's world, they should be devoting considerable time and effort in researching and using Internet resources so they can instead become effective facilitators of knowledge. Moreover, technology provides teachers the opportunity to find a better lesson plan, a more interactive demonstration, and a more effective instructional discussion. This does not mean that teachers are reduced to a trivial role void of content knowledge. As facilitators of learning, teachers encourage varied student-centered learning experiences, guide students to the right conclusions, help them answer complex questions, and redirect their misconceptions.

Finally, we cannot prepare students for their future by simply helping them answer multiple-choice questions on a state test. Life is complex, and being able to answer questions with a single correct answer does little to prepare students for today's world. Our goal should be to effectively promote highly rigorous and relevant learning in which students have opportunities to tackle challenging problems, the kind they are likely to encounter in life.

References

ACT. "College Readiness Increases Slightly Among ACT-Tested U.S. High School Grads, But
     Continued Effort to Improve Needed by States, Districts," Aug. 19, 2009:
     www.act.org/news/releases/2009/crr.html
ACT. *Act Profile Report* — National, 2009: www.act.org/news/data/09/pdf/National2009.pdf
Casner-Lotto, J. and L. Barrington. *Are They Ready to Work?* The Conference Board, October
     2006.
Ashford, E. *"*eSN Special Report: Virtual Desktops Save Schools Money — and Hassle,"
     eSchool News, March 2, 1010: www.eschoolnews.com/2010/03/02/esn-special-report-
     virtual-desktops-save-schools-money-and-hassle
Center for Public Education. "Practical Information and Analysis about Public Education," *The
     Eifier,* Nov. 30, 2009.
Cisco "Equipping Every Learner for the 21st Century" white paper. December 2008:
     www.cisco.com/web/about/citizenship/socio-economic/globalEd.html
Dauderstädt, M. and Stetten, J. "China and Globalization," Friedrich Ebert Stiftung, Sept. 2005:
     http://library.fes.de/pdf-files/id/02965.pdf
"Disruptive Technology," Sept. 2009: http://en.wikipedia.org/wiki/Disruptive_technology
Duncan, Richard. *The Dollar Crisis: Causes, Consequences and Cures.* New York: John Wiley,
     2003.
Engardio, Pete. "A New World Economy," *Business Week,* August 22/29, 2005.
Gee, James Paul. *What Video Games Have to Teach Us About Learning and Literacy.* New
     York: www.nytimes.com/2009/03/21/health/21patient.html?fta=y
"HighTechHire. Eastern Europe Makes Its Presence Known on the Global IT Scene," April 22,
     2009: www.hightechhire.com/a_EasternEurope_Global_IT_Outsourcing042209.php
India Resource Centre. www.ibef.org/industry/informationtechnology.aspx
Konrad, W. "Going Abroad to Find Affordable Health Care," *The New York Times*, March 20,
     2009.
Kripalani, Manjeet. "Trying to Tame the Blackboard Jungle," *Business Week*, Aug. 22/29, 2005.
Mellor, W. "China New Village Makes Chanos See Dubai 1,000 Times," Bloomberg News
     Service, Feb. 21, 2010:
     www.bloomberg.com/apps/news?pid=20601087&sid=azXVqyY6O8cQ
Peng, T. "Ultimate Outsourcing," *Newsweek*, Nov. 19, 2008:
     www.newsweek.com/id/169827/page/1Teaching Tips.com. "Education in China."
Schaffhauser, D. "Microsoft Enters K-12 Desktop Virtualization Market with MultiPoint Server,"
     The Journal, Feb. 24, 2010: http://thejournal.com/articles/2010/02/24/microsoft-enters-k-12-
     desktop-virtualization-market-with-multipoint-server.aspx
U.S. Department of Education. *National Educational Technology Plan*, April 2010:
     www.ed.gov/sites/default/files/NETP-2010-exec-summary.pdf.