Education in the United States: An Overview

➢ Fifty-two percent of children aged three to four are enrolled in some sort of educational program,\(^1\) while 54 percent of adults aged 16 to 64 have participated in a formal educational class or program.\(^2\)

➢ Student enrollment is expected to rise dramatically in the coming decades:

  ▪ **Preschool enrollment is increasing.** Enrollment in prekindergarten rose 679 percent between 1985 and 2008, from 0.2 million students to 1.2 million students.\(^3\)

  ▪ **Enrollment in public elementary and secondary schools is increasing.** Public elementary school enrollment (Pre-K to 8\(^{th}\) grade) rose by 28 percent between 1985 and 2010, while secondary school enrollment increased by 18 percent.\(^4\) Enrollment in public elementary and secondary schools is expected to set new records each year over the next decade, rising from 49.4 million students in 2010 to nearly 52.3 million in 2019.\(^5\)

  ▪ **Post-secondary enrollment continues to rise.** Undergraduate enrollment rose by 34 percent between 2000 and 2009, totaling 17.6 million students. This figure is expected to continue increasing until 2020, when undergraduate enrollment will reach 19.6 million students.\(^6\) Likewise, post-baccalaureate enrollment has risen every year since 1983, totaling 2.9 million students in 2009.\(^7\)

  ▪ **The student population is diversifying at a rapid rate.** Between 1989 and 2009, the percentage of public school students who were White fell from 68 to 55 percent, while the percentage of Hispanic students doubled from 11 to 22 percent. The total number of Black students also increased from 7.1 million to 7.8 million over this time period.\(^8\)
- A significant number of students with disabilities are being served. In the 2008-09 school year 6.5 million children and youth, or 13 percent of public school enrollment, received special education services.9

- Despite the seemingly positive connotations associated with increasing student enrollments, several negative trends persist:

  - Graduation rates are inadequate. Although U.S. public school graduation rates have generally improved over the past decade, 3 out of every 10 public school students fails to finish high school with a diploma. This equates to 1.3 million students failing to graduate each year.10

  - Demographic disparities exist in high school graduation rates. Over three-fourths of white and Asian students earn a high school diploma, compared to just 55 percent of Latino, 51 percent of African American, and 50 percent of Native American students.11

    - Minority students make up three quarters of the total enrollment of the nation's lowest performing high schools.12

  - A significant number of schools are classified as “high-poverty.” In 2008-09, 19 percent of all public schools were considered high-poverty, with 75 percent or more of their student enrollment eligible for free or reduced-price meals.13 Students at high-poverty schools face less qualified teachers, have lower reading and math scores, and lower graduation rates.14

    - According to the Alliance for Excellent Education, 84 percent of the nation's lowest performing high schools are considered to be high poverty schools.15

  - Considerable demographic achievement gaps exist. According to a 2009 report, African American and Hispanic students lag two to three years of learning behind white students of the same age.16 Likewise, impoverished students (those eligible for federally subsidized free lunches) are about two years behind their “better-off” classmates of the same age.17

  - College readiness among high school graduates is inadequate. By some estimates, less than half of students who do graduate from high school are adequately prepared for college or the workforce.18 Moreover, nearly 40 percent of “all students who enter college must take remedial courses.”19

  - U.S. students lag behind their international counterparts. U.S. students have generally underperformed on a number of exams testing a variety of skills,20 especially those in the math and science fields.21 According to the Program for
International Student Assessment (PISA), 17 countries have higher average mathematics test scores and lower income-based inequality than the U.S.\textsuperscript{22}

- \textit{Schools are generally failing to instill 21st century skills in students.} According to one report from 2006, “the future U.S. workforce is...woefully unprepared for today’s (and tomorrow’s) workplace.”\textsuperscript{23}

- The Obama Administration has made education an urgent priority.

- A framework for overhauling the U.S. education system and improving achievement was outlined by the U.S. Department of Education in its 2010 National Educational Technology Plan.\textsuperscript{24}

- This Plan sets out two goals that must be achieved by 2020 in order to spur economic growth and enhance the ability of our country to compete in the global economy:
  
  - Raise the proportion of college graduates (2- or 4-year degrees) from 39 percent to 60 percent.\textsuperscript{25}
  
  - Close the achievement gap so that all students – regardless of race, income, or neighborhood – graduate from high school prepared for college and the American workplace in the 21st century.\textsuperscript{26}

- In March 2011, President Obama announced a $90 million plan to support innovation in education,\textsuperscript{27} and toured the country speaking in support of the Administration's ongoing commitment to increasing the use of broadband-enabled educational technologies.\textsuperscript{28}

- In September 2011, the White House made a "Digital Promise"\textsuperscript{29} to facilitate the integration of new technologies into public schools in an effort to provide students with the knowledge and skills needed to compete in the global digital economy.\textsuperscript{30}

\textit{Broadband & Education: Assessing Broadband Availability & Adoption}

- The Availability of Broadband for Education

  - The FCC has found that broadband is available in 100 percent of census tracts in the United States.\textsuperscript{31}

  - Broadband providers continue to invest billions of dollars in physical infrastructure.\textsuperscript{32} Even so, broadband service still remains relatively scarce in some areas with low population densities.\textsuperscript{33}
Recent research suggests that broadband is widely available across the U.S. and that lack of availability deters just a small percentage of the population from accessing the Internet. One report found that just 4 percent of the total population claims that they are unable to access it. However, the percentage of people citing "lack of access" as the reason they do not have broadband is substantially higher in rural areas than in urban areas.

The federal government has placed a national priority on network build-out to unserved parts of the country and several programs are addressing these concerns.

Adoption of Broadband in Education

Nearly all schools in the United States are currently connected to the Internet.

- Estimates of school Internet connectivity range from 98 percent to 100 percent.
- In 2005, 97 percent of public schools with Internet access used broadband connections. This marks significant growth from 2000, when only 80 percent of schools utilized broadband.

As such, computer and Internet technologies are being widely incorporated into school curricula.

- Indeed, computer technology has been included in the curriculum standards of all 50 states as a subject students should be instructed in.
- Forty-six states include technology in their teaching standards.
- In 2009, teachers reported that they - or their students - used computers in the classroom during instructional time "often" (40 percent) or "sometimes" (29 percent).
- Also in 2009, teachers indicated that a system on their school or district network was available for entering or viewing the following: grades (94 percent), attendance records (93 percent), and results of student assessments (90 percent).
  - Of the teachers with one of these systems available, the percentage using it "sometimes" or "often" was 92 percent (grades), 90 percent (attendance records), and 75 percent (student assessments).
• Virtual schools were sponsored by 25 states in 2007, and 57 percent of the nation’s secondary schools provided online learning opportunities to their students in 2005. The majority of state-led programs are at the high-school level.45

• However, U.S. spending on education technology lags considerably behind that of other leading nations. CoSN recently reported that the U.S. spent $272 million on ICT in the classroom in 2009, or $5.44 per student (excluding the unusually high funding under ARRA in 2009). However, the U.K. spent approximately $20.10 per student, and the Netherlands invested $10.80 per student in 2009.46

• U.S. ICT spending may, however, see an improvement with the recently released National Education Technology Plan.47 In addition, researchers predict that worldwide IT spending on education will increase by 4.1 percent or about $2.53 billion during 2010.48

• Further, the integration of educational technology is largely dependent upon the quality of school Internet connections. Most school Internet connections currently support many concurrent users.49 As a result, the bandwidth available per student is often very low and under the minimum threshold that the FCC has designated as basic broadband.50

• One recent study estimated the national average access speed per student to be just 6.5 Kbps.51

• At these speeds, many of the potential cost-savings, quality improvements, and cutting-edge educational applications are inaccessible.52

• Indeed, though next-gen devices such as the iPad hold significant potential for education, several campuses have reported insufficient networks to support the devices. At Princeton and George Washington Universities, for example, the devices have been blocked from accessing the network altogether.53

• The lack of adequate computer access in some schools is a fundamental barrier to more robust broadband adoption.

• In the 2005-06 school year, 14.2 million computers were available for classroom use, which provided one computer for every four students.54

• A 2008 study found that over 54 percent of public school teachers reported having two computers or less in their classrooms and observed that this
number is inadequate to effectively use computers for instructional purposes.\textsuperscript{55}

- A 2009 study found that 97 percent of teachers had one or more computers located in the classroom every day, while 54 percent could bring computers into the classroom.\textsuperscript{56} This same study found that Internet access was available for 93 percent of the computers located in the classroom.\textsuperscript{57}

- A variety of individual computing approaches, including 1:1 laptop programs, have been launched in recent years to close this gap.

- School and classroom access to computers is critical since many students lack such equipment and broadband connections at home.

- Indeed, the OECD recently highlighted the existence of a second digital divide, in which lower levels of home computer use lead to inadequate technology skill development for students.\textsuperscript{58}

- Overall, 75 percent of parents with a minor child in the home had broadband access in 2009.\textsuperscript{59}

- However, just 59 percent of African Americans and 40 percent of households with incomes under $20,000 had adopted broadband by 2009, compared to 65 percent of all adults.\textsuperscript{60}

- Moreover, only 41 percent of students in the eighth grade who take part in the free and reduced lunch program had home Internet access in 2003, compared to 72 percent for those not participating.\textsuperscript{61}

- As a result, low-income students,\textsuperscript{62} African-American, and Hispanic children utilize the Internet from school much more regularly than other children.\textsuperscript{63}

- The likelihood of adopting broadband at home increases with education.

- Among all households in 2008, 83 percent of households headed by college graduates were connected to broadband at home, while only 38 percent of households headed by those with less than high school diplomas had adopted it.\textsuperscript{64}

- Despite household broadband adoption rates increasing from 19.9 percent in 2003 to 68 percent in 2010, the NTIA recently reported that 33 percent of
households with dial-up connections continue to claim that they do not need or want broadband service.\textsuperscript{65}

- Educating these households about the success of various broadband-enabled learning tools and the importance of digital literacy will likely change the opinions of non-adopters. The FCC is attempting to complete this task through its innovative "Connect to Compete" program, launched in late 2011.\textsuperscript{66}

- The costs associated with adopting and integrating broadband-based programs and services may be prohibitive for many schools.

- According to one estimate, technology integration programs can cost $15,000 per classroom and have a four-year lifespan. This would total $150 per student per year in a classroom of 25 students.\textsuperscript{67}

- The initial implementation costs for broadband access can range from several thousands of dollars to hundreds of thousands of dollars.\textsuperscript{68}

- In addition to implementation costs, the amount of time it takes to integrate new technologies into the curriculum and train teachers to become comfortable with the tools can significantly add to the program costs.\textsuperscript{69}

- A survey by the American Association of School Administrators recently found that, while the economy has begun to improve, education leaders are faced with considerable budget shortfalls that will be exacerbated next year when federal stimulus funding ends. To this end, 57 percent of respondents to a recent survey said they “plan to delay technology purchases in 2010-11, up from 29 percent in 2009-10.”\textsuperscript{70}

- However, many schools are overcoming the high costs of educational technology in innovative ways. Some are applying for grants and working with private organizations that agree to sponsor a classroom or school.\textsuperscript{71} Others use E-rate funds, and some schools are beginning to allow students to bring their own devices to school.\textsuperscript{72}

- There is currently a revised E-Rate 2.0 bill before Congress. Among its provisions are proposals that could increase broadband funding by $2.25B a year and extend telecommunications services to community colleges.\textsuperscript{73}

- Nevertheless, broadband connectivity is viewed by many as a great equalizer, removing the barriers that socioeconomic status traditionally upholds.
• A recent report issued by the U.S. Distance Learning Association reveals numerous ways that broadband connectivity is equalizing educational opportunities for students of all ages.\textsuperscript{74}

\begin{itemize}
  \item Schools that have and use Internet are facing the fact that 21\textsuperscript{st}-century education is driven by data and the way that it is stored.
  \item Data storage on campuses grows by over 50 percent each year.\textsuperscript{75}
  \item However, some estimates suggest that all education files contain duplications; better duplication practices can save terabytes of storage, improve data access times, and increase overall storage efficiency.\textsuperscript{76}
\end{itemize}

\textit{Broadband & Education: The Impacts of its Use Across the Continuum of Education}

\begin{itemize}
  \item Broadband and Pre-K to 12\textsuperscript{th} Grade Students
    \begin{itemize}
      \item In 2005, 96 percent of children ages 8 to 18 had gone online. Seventy-four percent had Internet access at home, and 61 percent used the Internet on a daily basis.\textsuperscript{77}
      \item About half of children age six or younger have used a computer, and 27 percent of children age 4 to 6 spend over an hour at a computer each day.\textsuperscript{78} Not surprisingly, children age six or younger spend nearly the same amount of time consuming digital media as they do playing outside.\textsuperscript{79}
      \item Of the 93 percent of teenagers that are online, 63 percent go online daily.\textsuperscript{80}
      \item Students in grades K through 12 pursue a number of online activities both in and outside of the classroom.
        \begin{itemize}
          \item Three-fourths of American children play computer and video games.\textsuperscript{81} Such tools have been shown to help children master course content and develop 21\textsuperscript{st} century skills such as literacy and complex problem solving.\textsuperscript{82} Moreover, such activities “allow teachers to tap into students’ enthusiasm for digital games to engage, expand, and empower them as learners.”\textsuperscript{83}
          \item A 2010 report estimated that more than 1 million K–12 students took online courses during the 2007 school year.\textsuperscript{84}
            \begin{itemize}
              \item A 2011 report by the Sloan Consortium revealed that the number of students taking at least one online course has now surpassed 6 million. In addition, nearly one-third of all students in higher education are taking at least one online course.\textsuperscript{85}
            \end{itemize}
        \end{itemize}
    \end{itemize}
\end{itemize}
By 2019, about 50 percent of courses may be delivered online.86

- Blended learning programs, which combine online learning with face-to-face instruction, are also being utilized.87 Some teachers are using Web 2.0 technologies like blogs, wikis, and Twitter to supplement in-classroom learning.

- Thirty percent of children aged 6 to 988 and 75 percent of 12 to 17 year olds own their own cell phone.89 Through broadband-enabled smartphones, students are able to engage in a number of activities, such as accessing course assignments, completing activities, playing games, reading educational materials, and communicating with teachers and classmates.

- Some recent studies have shown that there is up to a 30 percent improvement in learning when cell phone interactivity accompanies learning.90

- Due to the critical role technology has played in the lives of today’s K-12 students, they have an innate desire for more individualized experiences, require a high level of engagement in school, and see technology as more of a necessity or expectation than just as a useful tool.91

- The many uses of broadband by students in pre-K to 12th grade have had discernible impacts on student achievement and development of real-world skills.

- Utilization of broadband by students, via formal channels (e.g., in the classroom) and via informal channels (e.g., at home), increases the number of learning environments for educators, parents, and students.

- The flexibility and ubiquitous nature of broadband-enabled learning benefits students with limited ability to travel or who otherwise require home schooling.

- A survey of over 10,000 school districts found that 70 percent of respondents viewed distance learning as important for expanding access to courses not currently offered in their schools. Sixty percent cited the importance of distance learning for access to AP courses.92

- Traditional classrooms often lack in interactivity, with an average of less than 0.1 questions asked per hour.93 Computer-based instruction and tools utilized outside of the classroom encourage students to ask questions, retain student attention, and tailor content to meet various learning styles.94
• The U.S. Department of Education recently reported that, “[o]n average, students in online learning conditions performed better than those receiving face-to-face instruction.”

  o In addition, a 2002 study found that in households with broadband, “children ages 6-17 reported that high-speed access affected both their online and offline activities, including schoolwork.” Since getting broadband, 66 percent of participating children spent more time online, 36 percent watched less TV, and 23 percent improved their grades.

  o A study by the American Psychological Association found that low-income children who used the Internet on a regular basis performed better on standardized tests of reading achievement and had higher grade point averages than did children who used it less.

  o Additional studies have found similarly positive impacts of Internet usage on student achievement in reading, literacy, mathematics, and science.

• Moreover, several programs have seen marked improvements in learning outcomes as a result of Internet usage.

  o For example, students at the Florida Virtual Schools outperformed other students on AP tests and scored 15 percentage points higher than the state’s standardized assessment average in grades 6 through 10.

  o In Oregon, the Salem-Keizer School District has been able to re-enroll over half of high school dropouts and at-risk students through its online Bridge Program each year.

• Mobile learning has also been shown to improve student learning and lessen the digital divide among students.

  o Research by PBS KIDS shows that mobile applications can provide engaging educational experiences for children with significant educational outcomes.

    ▪ Another recent study found that children’s vocabulary improved by as much as 31 percent by playing the popular MARTHA SPEAKS mobile app.

  o Cell phones also play a critical role in bridging the digital divide for some minority teens and those from low-income households.
According to a 2010 Pew report, 44 percent of Black teens and 35 percent of Hispanic teens go online with their cell phones, compared to just 21 percent of white teens. Forty-one percent of teens from households earning under $30,000 say they go online from their cell phone.\textsuperscript{104}

Twenty-one percent of teens who do not otherwise go online say they access the Internet on their cell phone.\textsuperscript{105}

Just 70 percent of teens from low-income households have a home computer, compared to 92 percent of families with higher incomes.\textsuperscript{106}

- A 2011 survey by the Lone Star College System revealed that 78 percent of college students find the use of technology in the classroom to be beneficial in reaching both their educational and professional goals. Moreover, students reported that they care equally about the \textit{quantity} and \textit{quality} of the educational technologies used in the classroom.\textsuperscript{107}

- Broadband-enabled educational technologies have also been shown to play a critical role in the development of 21\textsuperscript{st} century skills.\textsuperscript{108} By engaging students more directly in the learning process, students are able to more quickly master course content and become adept at problem solving and participating in the creation of their own content via various forms of media.\textsuperscript{109}

\textbf{Broadband and Educators}

- Broadband enables a variety of beneficial applications for teachers.

  - Educators are using broadband to access online information to enhance curricula, improve teaching methods, and participate in professional development programs delivered online.

    - One study from 2006 found that an online teacher certification program prepared teachers just as successfully as traditional programs and was able to attract more diverse candidates. The program was also more successful in recruiting math and science teachers.\textsuperscript{110}

  - Educators are also using the Internet to complete certain administrative tasks and to deliver instruction.
In 2008, approximately 99 percent of K-12 educators reported using computers and nearly 95 percent reported using the Internet in school at some point over the prior year.\textsuperscript{111}

Seventy-six percent of educators report using such technologies for administrative tasks on a daily basis.\textsuperscript{112}

Teachers are also utilizing technology daily to communicate with other educators, post course information online for students, and communicate with parents through email.\textsuperscript{113}

However, less than half used technology for instruction-related activities.\textsuperscript{114}

Educators are also utilizing Web 2.0 tools for educational purposes. According to a recent study by the Consortium of School Networking (CoSN), “nearly three-quarters of [survey] respondents (superintendents and curriculum directors) said that Web 2.0 technologies had been a positive or highly positive force in students’ communication skills and the quality of their schoolwork.”\textsuperscript{115}

In addition, many public and school libraries are working with teachers to enhance learning experiences. Libraries are partnering with educators to collect resources that complement student research projects, offer online tutoring, participate in classroom visits, and are finding new ways to deliver resources on demand, outside of the school building.\textsuperscript{116}

Such broadband-enabled tools and applications are increasing both the efficiency and the quality of instruction.

As teacher effectiveness is closely tied to student achievement,\textsuperscript{117} such tools are likely to improve learning outcomes and foster the development of 21\textsuperscript{st} century skills.

Though many instructors are incorporating technology into everyday use, many remain reluctant to utilize new educational technologies and to adjust their teaching methods in response to technological advances.\textsuperscript{118}

One study found that 57 percent of faculty members who teach in “smart” classrooms (i.e., classrooms outfitted with advanced information and communications technologies) fail to use the technology on a daily basis.\textsuperscript{119}
Moreover, even though most students state that technology is an important aspect of learning, only 33 percent of faculty members report that technology is fully integrated into the education experience.120

- Several barriers to more robust adoption and utilization of broadband by educators explain this relatively low rate of usage.

  - **Lack of training.** In 2005, 83 percent of public schools with Internet access reported that their school or district trained teachers on how to integrate Internet technologies into the curriculum. However, 34 percent of schools offering professional development had less than 25 percent of teachers attend the professional development courses within the previous year.121

  - Moreover, a 2008 report found that, even when technology training is provided by school districts, educators believe that their training is more effective for administrative tasks, leaving them unprepared for instructional use.122

  - **Lack of technical support.** According to one study, 70 percent of educators report having sufficient technical assistance for technology use in their school, and just 67 percent report adequate help for troubleshooting or fixing problems with school technology.123

  - Further, a 2008 study found that educators in urban schools are more likely to report poor working conditions of school computers and less technical support to help with repairs.124

  - **Lack of supportive software.** Throughout the education industry as a whole, “little effort has been invested to promote the maturity of educational software products, especially software designed to fulfill the instructional requirements of teachers.”125

  - Moreover, many federal funding programs, such as E-Rate, do not provide for the software used in lesson planning, preparation, and individual instruction.126

  - **Organizational barriers.** While there is much support for a new “culture of learning,” acceptance of technology-centered education remains a concern among many educators.127

  - Cultural factors impacting teacher broadband usage include “beliefs about the nature of teaching and learning, recognition and awareness of their role as teachers based on this philosophy, and a perception of
the vision that technology may produce as they engage in instruction or promote learning.”

- In addition, teachers may be “accustomed to teaching within the traditional education model and are simply satisfied with the status quo.”

- A 2011 report published by the State Educational Technology Directors Association provides a snapshot of current technology requirements for select states implementing large-scale educational technology initiatives in grades 3-12 and identifies issues that states should consider as the shift from print to digital in K-12 education accelerates.

➢ Broadband and Higher Education

- College students are using the Internet frequently and for a wide range of activities.

  - About 94 percent of undergraduate students use the Internet to access the university library websites, and 42.4 percent of students report having contributed video to video websites via their school Internet connection, with 18.4 percent doing so weekly.

  - Around 71 percent of students engage in instant messaging regularly, 40 percent contribute to wikis monthly, and about 43 percent follow or update microblogs (e.g., Twitter) several times per week.

  - In addition, about 47 percent of students use the Internet to use Voice over Internet Protocol (VoIP) make phone calls (e.g., via Skype).

  - Social networking sites are also increasingly popular, with about 94 percent of 18-24 year old students having used social networking websites.

  - Half of undergraduate students own an Internet-capable handheld device and use it daily to access email, student administrative services, and course or learning management systems.

    - About 85 percent of students use their handheld device to check information (e.g., news, weather, sports), while approximately 77 percent engage in social networking, and around 38 percent conduct personal business (e.g., banking, shopping, etc.) and use mobile instant messaging.
• In the fall of 2007, over 20 percent of all U.S. higher education students were taking an online course. That number is expected to increase by at least 13 percent annually.\textsuperscript{138}

  o The 2008-2009 academic year saw an increase in community college distance learning enrollment of about 22 percent. This is due largely to an increase in the number of nontraditional students who require the flexibility of online courses.\textsuperscript{139}

• Broadband is also being employed for a number of additional uses within higher education institutions.

• Hundreds of projects are being developed by higher education institutions to demonstrate the power of mobile computing.

  o For example, Purdue University researchers recently developed Hotseat, a tool that encourages classroom participation. Students can use their mobile device “to contribute to discussions, ask and answer questions, and respond to teacher prompts through any of several channels, including Facebook, Twitter, the Hotseat mobile application, or a web application.”\textsuperscript{140}

  o In addition, a professor at Houston Community College recently found that those students utilizing an iPhone spent more time studying than those who just used a PC.\textsuperscript{141}

• Course management platforms are widely used for the creation of online learning environments and facilitating the administration of education processes.

  o Between 2000 and 2008, the percentage of college courses that utilized Course Management Software (CMS) or Learning Management Software (LMS) increased from about 15 percent to over 53 percent.\textsuperscript{142}

• Access to educational information in higher education is also being enhanced through the provision of open content on the Web.

  o Open content allows educators to leverage the Internet as “a global dissemination platform for collective knowledge and wisdom, and to design learning experiences that maximize the use of it.”\textsuperscript{143}

  o Currently, more than 250,000 individual classes are available through iTunes U from 600 colleges and universities.\textsuperscript{144} In December 2009, iTunes U surpassed 100 million downloads.\textsuperscript{145}
According to one expert, about $150 million has been spent on open education in the past ten years, and new sources of funding contribute each year.\textsuperscript{146}

Participating schools are finding that a diverse group of learners are accessing their online materials. Nine percent of participants in the M.I.T. OpenCourseWare program are educators, 42 percent are students from other institutions, and 43 percent are independent learners.\textsuperscript{147}

An outgrowth of the movement towards open content is the provision of open textbooks that can be customized or combined with other materials by educators. Flat World Knowledge, for example, provides free electronic copies of textbooks and charges students only for the print editions.\textsuperscript{148}

A recent report by Grunwald Associates found that “[t]he greater a state’s current investment in open source technology and its education leaders’ and educators’ awareness of what it offers, the greater the prevailing interest in increasing its use, in advancing its quality, and in becoming better educated about the technology and the content it propagates and has the potential to offer”. In addition, the researchers claimed that “[e]ducation leaders need to be better educated about both the benefits and risks of open source technology and its related issues”.\textsuperscript{149}

Digital technologies hold much promise for the future of higher education.

According to a New Horizon Report, “The implications for informal learning are profound, as are the notions of ‘just-in-time’ learning and ‘found’ learning, both ways of maximizing the impact of learning by ensuring it is timely and efficient.”\textsuperscript{150}

Indeed, online and blended learning programs are seeing considerable successes in universities across the nation.\textsuperscript{151}

- At the University of Idaho, algebra and pre-calculus students meet for just one class per week and spend at least 2 and-a-half hours in the Polya Mathematics Center completing computer-based learning models at their own pace.\textsuperscript{152} Since Polya was introduced, the percentage of students passing introductory math at UI has improved from 62 percent to 70 percent and the number of students who withdraw from or fail the course has dropped by 20 percent. Moreover, the per-person cost to the
university is 30 percent lower than that of traditional courses, saving the university over $1 million.\textsuperscript{153}

- Similarly, Carnegie Mellon University saved more than $23,000 by developing an electronic tutoring system for its statistics course. Participating students scored 30 percentage points higher on statistical concepts than those in traditional classes.\textsuperscript{154}

- More and more, students "expect to be able to work, learn, and study whenever and wherever they want."\textsuperscript{155} This has given rise to many adoption programs seeking to connect underserved communities as well as wireless network expansion in new locations (e.g., restaurants, airplanes).

  - Moreover, electronic books and mobile phone apps are moving towards mainstream adoption in higher educational institutions worldwide.\textsuperscript{156}

➢ **Broadband and the Administration of Education**

- Broadband is also being used for a number of cost-saving and efficiency-generating administrative purposes.

  - Data systems are increasingly being utilized to improve the monitoring and management of student progress and achievement.\textsuperscript{157}

    - At least 31 states are now employing student databases to track academic progress, an improvement from 12 percent in 2005.\textsuperscript{158}

  - Broadband is also being used to facilitate the aggregation, storage, and analysis of student-generated data.

  - Broadband also allows for more widespread use of open-source and cloud computing services, which streamline various information technology processes and decrease costs.

    - By one measure, open-source products can cost 10-13 percent less than licensed commercial products with equivalent capabilities when considering the total cost of ownership.\textsuperscript{159}

    - The use of these types of resources is increasing in American universities, and nearly 60 percent of campus IT officials believe that they will play an increasingly critical role in future plans. Further, 40
percent claim that their campus is currently testing such tools for use in central IT services.\textsuperscript{160}

- Such uses have two core impacts on education administration.
  - \textit{First}, broadband-enabled administrative tools provide schools an array of lower-cost options for pursuing certain IT projects.
  - \textit{Second}, utilizing broadband facilitates administrative and operational efficiencies. For example, the reporting capabilities of student tracking systems are being improved upon, data warehouses are being utilized to streamline reporting, and standard imaging solutions are being installed to facilitate office workflows.\textsuperscript{161}

\textbf{Broadband and Adult Education}

- Online learning programs allow professionals to further their education, whether for job training or continuing education, in a flexible, self-paced format that can be incorporated into their lifestyles.

- As online degrees have become more commonplace, many employers now view such opportunities as a viable alternative to traditional education. Indeed, “85 percent of employers representing a variety of industries across the U.S. feel that online degrees are more acceptable today than they were five years ago.”\textsuperscript{162}

- Broadband connections are now being widely utilized by corporations to deliver training. Indeed, “[t]echnology was used to deliver 37 percent of formal training in 2005, up from 24 percent in 2003.”\textsuperscript{163} In addition, “e-learning made up [nearly one-third] of all learning hours in the private sector in 2007.”\textsuperscript{164}

- IBM found that its e-learning program “enables managers to learn five times as much material at one-third the cost of a classroom-only approach.”\textsuperscript{165} Through online learning, IBM claims to have saved $579 million in two years.\textsuperscript{166}

\textit{Summary of Observations Regarding Broadband and Education}

- Broadband has the potential to revamp the nation’s education system by lowering delivery costs, increasing access to educational environments, and enhancing the quality of instruction.

- In general, students are avid technology users and are embracing broadband-enabled technologies for an array of education opportunities.
A growing number of educators are using broadband-enabled tools to enhance their curricula, to augment classroom instruction, to engage students in learning outside of the classroom, and to participate in a variety of online professional development opportunities.

Higher education institutions have proven adept at leveraging high-speed broadband networks to provide coursework and resources and to manage classes through online learning environments.

Online learning is a significant trend in K-12 schools, higher education, and private-sector professional development. Online learning decreases the costs of education, increases access to such opportunities regardless of geographic location, and improves the effectiveness of instruction.

Broadband-enabled tools are increasingly being used to create efficiencies and cost-savings in the administration of education across all levels.

For the many positive impacts of broadband to be realized, however, a number of barriers must be addressed. These include a lack of sufficient computer access, technical training and support for incorporating technology into instruction, negative perceptions regarding the value of using broadband in the classroom, and a variety of cost issues associated with purchasing the necessary equipment.
ENDNOTES


4 Id.

5 Id. at Table 3.

6 Condition of Education 2011, Indicator 8, at p. 34.

7 Id. at Indicator 9, p. 36.

8 Id. at Indicator 5, p. 28.

9 Id. at Indicator 7, p. 32.


11 Id. at p. 4.


13 Condition of Education 2011 at p. 84.


15 Prioritizing Nation’s Dropout Factories, at p. 5.


17 Id at p. 12.


21 Achievement Gap at p. 7 (Citing PISA findings).

22 Id. at p. 8, Exhibit 2.


31 It is estimated that companies invested approximately $30 billion in broadband infrastructure in 2009. See Broadband in America: Where it is and Where it is Going, at p. 11, Report to the FCC, Columbia University, Institute for Tele-Information (Nov. 2009), available at http://www.broadband.gov/docs/Broadband_Stats - October 2011.pdf.

32 FCC Broadband Stats - October 2011 (analyzing high-speed subscribership by household density).


For example, billions of dollars were included in a 2009 federal stimulus bill for broadband network build-out. See Bill Summary: Energy and Commerce Provisions on Healthcare, Broadband and Energy, U.S. House of Representatives Committee on Commerce, Feb. 12, 2009, available at http://energycommerce.house.gov/Press_111/20090212/economiceecoverysummary.pdf. In addition, the FCC has issued a rural broadband strategy to spur deployment and adoption in these areas; enhancing educational opportunities in these areas via broadband is a key component. See generally Michael J. Copps, Bringing Broadband to Rural America: Report on a Rural Broadband Strategy, FCC (rel. May 22, 2009), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291012A1.pdf. Existing programs – e.g., the Distance Education and Telemedicine Program administered by the Department of Agriculture’s Rural Utilities Service – also provide funding and other support for broadband deployment and adoption for educational purposes in rural areas. Id. at n. 118.


41 Id.


43 Id.

44 Id.

45 Id.


49 Breaking Through the Barriers at p. 6.


52 Breaking Through the Barriers at p. 4.


56 Educational Technology in Public Schools: 2009 at 3.

57 Id.


59 Broadband Adoption and Use in America at p. 7.

60 Id. at p. 3.


68 Id.


Cliff Hanger: How America’s Public Schools Continue to Feel the Impact of the Economic Downturn, an April 2010 study by the American Association of School Administrators (AASA)).

71 Mobile Learning Costs (citing Cathleen Norris, with the University of North Texas).

72 Id.


75 Id. at p. 21.

76 Id.


78 Id.

79 Id.


82 Id.; see also ENGINEERING PLAY at p. 82-84 (discussing the impacts of video games on how children learn and participate in education).

83 Digital Promise at p. 10.


86 See Clayton M. Christensen and Michael B. Horn, How Do We Transform Our Schools? Education Next, Vol. 8, No. 3 (Summer 2008), at http://educationnext.org/how-do-we-transform-our-schools.


Educating the Net Generation, at p. 2.13.

Id.

Evaluation of Online Learning at p. ix.

Connected to the Future at p. 8.

Id.


Digital Promise at p. 3 (citing the International Society for Technology in Education, 2008).


Id at p. 228.


Id. (citing Rockman et al).


Id at p. 4.

Id.


110 National Broadband Plan at p. 228 (Citing Pamela E. Harrell & Mary Harris, Teacher Preparation Without Boundaries: A Two-Year Study of an Online Teacher Certification Program, Technology & Teacher Education (2006)).

111 NEA 2008 at p. 19.

112 Id at p. 20.

113 Id.

114 Id.


117 The Digital Promise at p. 8-9.


120 Id. at p. 4.


122 NEA 2008 at p. 3.

123 Id. at p. 14.

124 Id. at p. 15.

125 SIT 2007.

126 NEA 2008 at p. 16.

127 SIT 2007.

128 21st Century Campus.

129 SIT 2007.

130 21st Century Campus at p. 6.

131 See Technology Requirements for Large-Scale Computer-Based and Online Assessment: Current Status and Issues, State Educational Technology Directors Association (June 2011), available at http://assess4ed.net/sites/default/files/techrequirements_june22_combined_0.pdf.


133 Id.

134 Id.

135 Id. at p. 63.


Id.

Id.


Id. at p. 4.


Id at p. 1.

Id at p. 2.

Id.


Id. at p. 5.

The Digital Promise at p. 7.


