21st Century Trends for Higher Education

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"Education and training are key drivers of competitiveness. As the global economy has become more complex, it has become evident that to compete and maintain a presence in global markets, it is essential to boost the human capital endowments of the labor forces, whose members must have access to new knowledge, [and] be constantly trained in new processes and in the operation of latest technologies."

–World Economic Forum
  2006 Global Competitiveness Index

Introduction

To help universities, colleges, and technical institutions achieve these goals, this paper describes the Cisco Internet Business Solutions Group's (IBSG) point of view on 11 key trends for higher education in the 21st century, along with the role of technology in each. By understanding these trends and technologies, higher education institutions will be able to prepare students to become the next generation of productive employees and innovative leaders the world needs.

These trends include:

1. Evergreen students
2. Globalization
3. Faculty support
4. Smart buildings
5. Enrollment and retention
6. Job alliances
7. Mobility
8. Safety and security
9. Library transformation
10. Web 2.0 and interactive teaching
11. Data management

Trend 1: Evergreen Students

More than any other kind of organization, higher education institutions must cater to a rapidly changing clientele as influxes of new, or "evergreen," students enter their campuses. Adding to this challenge is that evergreen students are technology savvy and expect their schools to offer the same technologies they use every day.

Each year, evergreen students bring with them the consumer trends and technologies they've adopted into their lifestyles. Over the past five years, cell phones, music downloads, Flickr, MySpace, Facebook, and YouTube were popular. This year and next, Second Life and movie downloads should join the list.

These trends and technologies improve and customize the learning experience by allowing students to access content no matter where they are, create their own communities, and personalize interactions through photos and videos.

Educators and technologists need to keep up with these changes both on campus and in classrooms. Developing a technology curriculum and financial strategies for the future are key ways institutions prepare for these changes.

Trend 2: Globalization

There is growing demand for international experience from both companies and students. As business becomes more global, companies want to hire individuals who can work and socialize in a variety of environments and cultures. Students who want to be more competitive in the job market are also seeking international experience.

In response to these demands, some universities are putting increased emphasis on international programs. Several already require students to spend time in another country learning the language and customs before they graduate. Some schools develop overseas partnerships to enable student exchanges, while others offer students terms abroad with their own professors. Universities are also working to make their curricula more internationally focused by developing synchronous (real-time) and asynchronous (not in real time) distance-learning classes with global higher education institutions.

In a strong show of commitment, several institutions are building campuses in other countries. This allows students to transfer easily to the new campus and continue their education while immersed in a foreign language and culture.

As universities plan international initiatives, technology can be a key enabler:

- **Cisco TelePresence:** Cisco TelePresence integrates audio, video, and collaboration capabilities into a life-like communication experience. It allows universities to set up live meetings for people at different locations. Students can also collaborate with other students or take classes from professors at a university in another city or country.

- **Distance learning:** Universities are using distance learning to extend their virtual campus to students all over the world. In addition to using Cisco TelePresence, universities can create online courses, making content available on a secured

Website and requiring students to e-mail assignments to their professors. Universities can also use video clips, simulations, online collaborative environments such as WebEx and Second Life, and virtual classrooms to enable distance learning.

- **Secure communications:** Universities are ensuring that students who participate in foreign exchange or distance-learning programs have secure access to university resources.

Trend 3: Faculty Support

Unlike students, some faculty members have not grown up using computers, so they may not eagerly adopt new technologies without some training. Given students' expectations, faculty members who are not comfortable using technology may need additional support and attention.

To close the technology gap between faculty members and their students, universities are providing innovative education programs and IT support for faculty members. Most schools are finding that success requires both concerted effort and investment.

Some universities actively involve students in the education of faculty members. Other institutions reward fast adopters by providing research stipends or articles in campus newsletters and other forums that highlight their success.

For example, one school hires students as advisers to provide individual instruction on the use of technology. Other institutions provide training centers and offer incentives, such as free laptops or research stipends, for faculty members who complete the training. The table below shows additional training activities and the percentage of universities using them.

Initiatives to Train Faculty in the Use of Technology	Percent of Education Institutions
Faculty training upon request	94%
Faculty training through scheduled seminars	87%
Designated instructional technology center	73%
Activities for faculty to share innovative ideas	72%
Instructional designers who work with technologists	57%
Faculty teaching/excellence center that works with IT	56%
Intensive support for faculty using technology	52%
Special grants/awards for faculty using technology	40%
Instructional technologists who are discipline specialists	20%

Source: Educause Core Data Service, *Fiscal Year 2004 Summary Report*, September 2005; Brian L. Hawkins, Julia A. Rudy, and Robert Nicolich; Table 3-5, pp. 32, 113.

Finally, some colleges provide faculty members with technical support to supplement their training through IT-supported initiatives such as help desks, pagers, and automated classrooms.

Trend 4: Smart Buildings

As higher education institutions update their buildings and construct new ones, many are planning technology-enabled "smart buildings." These buildings are designed to meet current needs, as well as to provide a platform for the future.

Smart buildings include flexible classrooms and spaces that can be used in multiple ways to accommodate the needs of nearly any discipline. Furniture is also movable and can be easily stored for quick turnaround of classes. This flexibility also allows space to be reconfigured for school functions or rented to other organizations.

In smart buildings, walls become active parts of the classroom and support a variety of cutting-edge technologies, such as video, whiteboards, and LCD and document projectors. Video walls are particularly helpful in immersing students in class assignments by projecting research, streaming broadcasts of leading speakers, showing podcasts, and even displaying YouTube video clips. Smart consoles, which can be placed anywhere in the classroom, allow educators to control all these capabilities.

Smart buildings are also equipped with both wired and wireless networks to provide voice, video, and data services, as well as heating, ventilation, and air conditioning (HVAC) control. This increased control translates into greater operational efficiencies by minimizing power consumption, reducing utility bills, and protecting the environment. Recent studies also suggest "green" environments that include enhanced lighting and facilities increase student performance and reduce absenteeism.[1,2]

The following table lists the percentage of U.S. classrooms equipped with various technologies.

Technologies	Percent of Classrooms
Wired Internet connectivity	87%
LCD projectors	51%
Computers	42%
Wireless Internet connectivity	34%
Televisions	32%
Document projectors/systems/cameras	19%
Smart boards	5%

Source: Educause Core Data Service, *Fiscal Year 2004 Summary Report*, September 2005; Brian L. Hawkins, Julia A. Rudy, and Robert Nicolich; Table 3-4, pp. 31, 113.

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[1]Capital E, Greening America's Schools: Costs and Benefits, October, 2006
[2]California Energy Commission, Windows and Classrooms: A Study of Student Performance and the Indoor Environment, October 2003

Trend 5: Enrollment, Retention, and Branding

Enrollment, retention, and branding are key areas where technology continues to play an important role. Some schools are now using technology to market their institutions more effectively to attract new students, as well as to create communities among existing students to improve retention.

Some schools use Internet advertising to attract new students, purchasing advertising on Websites to generate leads that are directed to call centers for follow-up. Others use multimedia e-mail messages, rather than traditional mail, to send students acceptance letters. Universities are also hosting virtual e-parties, inviting prospective students to chat with current students, alumni, and faculty.

Several universities with high dropout rates have successfully used text messaging to send personalized messages to students, encouraging them to attend class. Schools have also used e-mail to invite these students to online discussion groups where they can talk about relevant issues.

Higher education institutions are also using voice over Internet Protocol (VoIP)-enabled call centers to contact students. For example, a call center can follow up on leads from the Internet for new enrollments or leave personalized voicemails for students who have missed classes.

Trend 6: Job Alliances

Most students look at higher education as a way to secure a career. To smooth the transition from school to work, universities have cultivated partnerships with companies to increase job placement. These partnerships have been economically beneficial for the schools and provide an ongoing pipeline of talent for employers.

In the 21st century, new programs and technologies will make these partnerships even more profitable:

- **Partnerships:** New technologies allow students to explore nontraditional internship opportunities. For example, a college could partner with an oil company, placing students on remote rigs. While on board, interns learn in a real-world environment and can keep up with their studies using distance-learning technologies such as video exchanges, virtual classrooms, and online materials.

- **Aligned curricula:** Education must keep pace with an economy that increasingly relies on emerging and specialized technologies. To prepare students better for their chosen careers, some schools consult with companies to design relevant curricula.

- **Continual seminars and life-long learning:** After leaving school, many students work in fields that require ongoing education and training. Working with local companies, several schools are developing appropriate curricula for continual seminars, distance learning, and just-in-time learning.

- **Real-world education:** Some institutions provide students with unique applied opportunities beyond traditional lecture-based classes. For example, students at one institution buy and sell stocks in a live trading room environment. Such real-world experiences make students far more employable.

The Cisco Networking Academy (CNA) program is one of the best examples of alliances between companies and educational institutions. For more than 10 years, this program has trained students around the world to become highly skilled IT employees. The CNA places cutting-edge curricula within reach of nonprofit educational institutions by providing many services for free, and by relying heavily on online materials, automatic scoring software, and Web-based learning.

Trend 7: Mobility

Students today are mobile, connected, and seemingly much busier than students in the past. Many hold jobs, conduct academic research, and participate in extracurricular activities such as sports, student administration, and community outreach projects.

With all these demands on their time, students are frustrated when institutions force them to go to a classroom to complete a task that could easily have been performed online. Students are also stifled when schools do not provide full access to the Internet through wireless environments.

Students expect institutions to deliver certain information and services—including viewing grades, applying for classes, paying for parking passes, scheduling appointments with faculty and staff, paying bills, and ordering class materials—to them whether they're at home, at work, or on campus.

Many schools have realized the benefits of providing wireless coverage across their entire campuses. In fact, some schools are so sure of their service coverage that they offer T-shirts to students who can find "holes" in their network.

As students move beyond traditional campus boundaries into the community, the network must follow them. Some schools are extending wireless coverage to neighborhoods that border their campuses, and in some cases, to the entire community. This creates expansive learning environments that connect the schools with museums, art galleries, libraries, hospitals, zoos, and other points of interest.

Some institutions are even ensuring that the network follows students during internships or while studying abroad. For example, one university provides students with personal digital assistants (PDAs) that let them complete and submit assignments remotely.

Many other services and kinds of information are now being made available wirelessly:

- Completing online applications
- Finding and filling out financial aid forms
- Choosing a dorm room

- Registering for classes
- Browsing cafeteria menus and managing a food plan
- Viewing information about the campus, such as shuttle bus schedules
- Searching the library catalog and databases of academic articles
- Checking grades and test scores

Trend 8: Safety and Security

Safety and security have always been top-of-mind issues for administrators. In addition to confronting traditional physical threats, administrators must also now address virtual threats such as:

- Lost data due to disaster or failed equipment
- Identity theft and stolen intellectual property
- Denial-of-service attacks
- Worms that infiltrate the network, destroying data and interrupting network service

Whatever the threat, universities are employing technology to protect their information assets.

To secure physical facilities and protect students, institutions are using network surveillance in all public areas to discourage theft and more serious crimes such as assault. In addition, many use radio frequency identification (RFID) tags to account for classroom assets such as overhead projectors and laptop computers.

In the aftermath of the Asian tsunamis and U.S. hurricanes, education institutions are also focusing on disaster planning. Many are hiring risk managers to create disaster recovery policies, formulate risk plans, and train staff. As part of their disaster recovery planning, higher education institutions are re-evaluating their backup strategies. Several are backing up their data over research networks to low-cost storage devices at other locations that are not prone to the same natural disasters that could threaten the main campus.

These plans can be augmented with technology solutions such as the Cisco IP Interoperability and Collaboration System (IPICS). By integrating radio, push-to-talk phones, IP phones, and PCs with client software, IPICS allows universities to respond more quickly to disasters on campus and within their communities.

Universities are also taking steps to protect their confidential student data and proprietary research from hackers. By automating the deployment of security patches, universities are proactively safeguarding their networks from the latest worms and viruses.

Trend 9: Library Transformation

Campus libraries are quickly becoming crossover points between academia and IT as they evolve from quiet, austere environments to bustling production and collaboration centers.

One noticeable difference is that today's libraries have fewer books, which are quickly being replaced by digital alternatives. The paper books haven't been thrown away or recycled, but are being kept in robotic-enabled storage areas that often use RFID tags to improve inventory.

As more professors use new multimedia technologies, libraries are also streaming video and audio clips to classrooms, dorms, and laptop computers.

Today's campus libraries are also becoming more than just repositories for digital data. They are now used as common grounds or "commons" where students gather to visit and collaborate on projects such as creating videos or multimedia presentations. Many schools make commons available 24 hours a day.

Trend 10: Web 2.0 and Interactive Teaching

Web 2.0—a term often used to describe the latest advancements in collaborative Web technologies—has transformed online users from passive browsers of content to active editors and publishers. Web 2.0 is also changing higher education. Studies in pedagogy have shown that students learn more when exposed to information through a variety of senses, and they learn best when involved in the actual teaching experience.

Web 2.0 technologies allow faculty to provide students with more interactive experiences:

- **Podcasting:** With lectures available as podcasts, students can review information at their own pace. This is ideal for students who want the flexibility to listen to lectures when they want, as opposed to going to class at an assigned time. It is also useful for international students who might find language a barrier.

- **Blogs:** The use of blogs by experts in various fields to share their knowledge is rapidly increasing. For example, Larry Lessig, Stanford Law School, founder of the Center of Internet and Society blog (http://www.lessig.org/blog/), keeps participants in an active dialogue about copyright issues and the Internet. Because blogs encourage commentary, students learn not simply by absorbing information, but also by processing, analyzing, and responding to it.

- **Wikis:** Wikis provide an ideal medium for students to pool their knowledge and learn by teaching each other. Using wikis, students can comment on information, spurring analysis and discussion. Wikis can also incorporate multimedia such as animation, voice, music, and video.

- Gaming simulations: Hours of listening to lectures cannot replace the learning that happens when students actually practice a skill. Simulations bring students to environments that are otherwise inaccessible. For example, using gaming technology, archaeology students can "virtually" explore real dig sites from around the world.

- Avatar-based virtual classrooms: Colleges and universities find themselves accommodating more and more students at remote sites. In a virtual classroom, students and faculty can meet—no matter where they are located physically.

Trend 11: Data Management

Digital data is proliferating exponentially. The amount of data stored per person worldwide has doubled every year since 2001, reaching 4 gigabits (GB) in 2005. If this trend continues, the amount of data stored per person will reach 128 GB in 2010 and 131,072 GB in 2020. This vast amount of data threatens to "bury" education institutions in particular because they are, by definition, repositories of information.

Higher education institutions must also store vast numbers of student records. Because student attendance is constantly changing, the amount of data stored is constantly growing. Many colleges and universities also offer students and faculty lifetime e-mail accounts, which can add up to a crippling mass of message storage.

In addition, universities have started digitally archiving their libraries, and many students produce, store, and share large video and audio data files with each other and for class assignments.

As data grows beyond gigabytes and terabytes to yodabytes, schools are grappling with how to store it all. New storage technologies help, but require investment of limited IT funds. In addition, data centers consume power, and many colleges and universities have committed to environmentally sound practices by cutting power consumption as much as possible. All of these concerns have created an environment in which every available byte of storage must be used efficiently.

Summary

In the 21st century, technology will play an ever increasing role in higher education. Institutions will adopt technologies that will change the way students learn, communicate, produce, collaborate, and study, as well as improve interactions between faculty, staff, and students.

Creating innovative services from these technologies requires a powerful, reliable, expandable, and secure IT infrastructure that has adequate bandwidth, quality of service (QoS), and storage. Many colleges and universities have already developed short- and long-term plans to ensure success in meeting their current and future needs.

More Information

The Cisco Internet Business Solutions Group (IBSG), the global strategic consulting arm of Cisco, helps educational institutions transform the way they operate through process alignment, best-practice sharing, and by integrating advanced technologies into visionary roadmaps.

For further information about IBSG, visit http://www.cisco.com/go/ibsg

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